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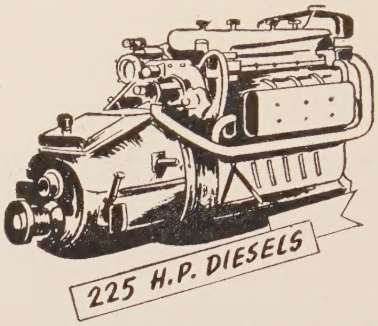

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WESTERN AUSTRALIA

Vol. 22 (Second Series) DECEMBER, 1945. No. 4.

Recent Developments in Australian Wheat-Breeding.

I. THOMAS, Registrar Cereal Varieties in Australia; A. J. MILLINGTON, Plant Geneticist.

In 1927 a conference of the State Ministers for Agriculture at Adelaide resolved that to avoid duplication, the names of new cereal varieties be circulated among the States and subsequently confirmed at a meeting of Ministers. Later the Standing Committee on Agriculture decided to further discourage the indiscriminate release of varieties and in 1937 the following resolution was carried:—

> That each State proposing to introduce a new cereal variety should advise the other States giving full characteristics including yield, milling value and baking qualities and also stating the variety or varieties it is proposed to replace.

This cereal registration system although purely voluntary has achieved its principal objectives of preventing duplication of names and the indiscriminate release of varieties. It has served also to keep breeders advised as to new releases.

The procedure in brief is that an organisation wishing to release a new variety for general cultivation submits particulars of its morphology, disease resistance and yielding capacity, together with the proposed name and pedigree to the Registrar. The information is then forwarded to the organisations engaged in cereal breeding to ascertain whether they have any objections to the proposed registration. In the absence of objections the variety is accepted and the Agricultural Council advised.

During the period 1927-1945, several publications have appeared which list the wheat varieties in Australia. The first of these, "Varieties of Wheat in Australia" was published by the Council for Scientific and Industrial Research in 1933 and compiled by Dr. J. R. A. McMillan of that organisation.

This catalogue gave the pedigree or source of each variety and contained a genealogical chart showing the relationships of the more important varieties.

The *Agricultural Gazette,* official organ of the N.S.W. Department of Agriculture over the period November 1st, 1938, to July 1st, 1941, published a review entitled "Wheat Varieties in Australia." This is a most useful publication but it unfortunately has not appeared as one volume.

It was proposed at the inauguration of the registration system that a list of the new cereal varieties would be published each year in the Journals of the various State Departments of Agriculture. The W.A. Department of Agriculture

hopes to be able to do this in future, and to initiate the practice the following catalogue has been compiled of the wheat varieties registered since 1927. A few leading varieties produced before then have been included. Extensive use has been made of the *Agricultural Gazette* as a source of particulars of some varieties.

The opportunity is also taken to review some of the important developments in wheat breeding during the period that the registration system has operated.

Varieties.

Nabawa rose to almost unchallenged leadership when it in 1934 occupied 17 per cent. of the Commonwealth acreage. In Western Australia and later in the other States, it was displaced by Bencubbin which in 1940 was the leading variety sown over 22.7 per cent. of the wheat areas of Australia. Other varieties which have shown a sharp decline are Free Gallipoli, which fell from 12.4 per cent. of the total in 1934 to 1.7 per cent. in 1940. In general the changes have been due to varieties of higher yielding capacity with no marked changes in respect to disease resistance or other major characteristic.

During the war period varietal statistics for the Commonwealth have not been available but it is known that changes have occurred in the area sown to the various wheats. In W.A. Bungulla is of increasing importance. ([1]) Its early maturity makes it suitable for delayed planting on fallows when no early rains fall to germinate weeds and on ploughed-up clover ley land it yields satisfactorily despite late seeding.

Ranee has occupied a fairly constant position among Australian varieties and in each of the seven years 1934-40 it occupied either second or third place.

Dundee rose rapidly from one per cent. in 1934 to 8.3 per cent. in 1940 and Ghurka over the same period increased from 3.8 per cent. to 11.4 per cent. of the total area.

Disease Resistance.

The major wheat diseases have received attention from plant breeders in Australia. Two of the principal ones, flag smut and bunt are now controlled, the former by resistant varieties and the latter by fungicides.

Wheat Rust.

A number of rust resistant wheats have been registered but as yet none has become a leading variety. Three sources of resistance to the major Australian rust races have been differentiated by Drs. Waterhouse and Watson, ([2]) in the Kenya crossbred varieties of unknown pedigree imported by the N.S.W. Department of Agriculture. A fourth is a mature plant resistance derived from the American wheat Hope. In certain N.S.W. districts a bio-type of rust Race 34 which is the predominant one in Australia has appeared. This strain is capable of attacking at high temperatures one of the Kenya cross-bred varieties and also its derivatives, notably Eureka.

The types of resistance present in Kenya C 6041, Kenya C 6042 and the durum variety Gaza confers immunity throughout the life of the wheat plant to all Australian rust races and it is being used extensively in breeding programmes. Dr. S. L. Macindoe of the N.S.W. Department of Agriculture has suggested a method for combining the Kenya and mature plant types of resistance in one variety. ([3]).

Flag Smut in Wheat.

Resistance to flag smut is possessed by most varieties now being released by Australian plant breeders. Nabawa and its derivatives possess a high degree of resistance which has been achieved without sacrificing yield. From the viewpoint of the plant breeder it is interesting to note that the very resistant varieties have not been attacked by new physiological races.

Smuts.

Although the use of fungicides gives excellent control of bunt, wheat breeders are giving attention to the development of resistant varieties. Work at the Waite Institute has demonstrated the importance of physiological races and directed attention to the durum variety Doubbi.([4]). A survey of varietal reaction to loose smut has been made also at the Waite Institute.([5])

Flour Strength.

Discussions on flour strength usually resolve themselves into attempted justification of lower yields to obtain greater flour strength, the reduction to be compensated by a higher price.

The problem to the plant breeder is therefore to increase flour strength without sacrificing yield. The introduction during the period under review of the Pelshenke and Farinograph Tests have enabled the Cereal Chemist to materially aid the wheatbreeder, useful tests being possible on about one-half ounce of grain.

A publication in this Journal by Dr. L. M. Samuel ([6]) shows that rotation practice and hence soil fertility level is of extreme importance to the expression of the inherent genetic capacity of a variety to produce strong flour. It is of small value to breed varieties capable of producing flour of greater strength if environmental conditions do not permit the character to express itself.

Not only does the rotation result in flour of greater strength with available varieties but it gives greater yields of grain also. In W.A. at least, the flour strength of the f.a.q. could be materially raised with the present varieties if better rotations were practised. Table I. shows the flour strength figures of two varieties and two crossbreds grown on land with and without previous leguminous crops.

WONGAN HILLS RESEARCH STATION 1943.

Variety.	Flour Strength Figure (Farinograph).	
	Following Lupins.	No legume in the Rotation.
Eureka II.	12·2	4·5
Gluclub	4·8	2·1
Crossbred W. 12	8·8	2·8
Crossbred W. 18	7·4	2·3

It is evident that the inherent capacity of the crossbreds to yield flour of satisfactory strength is of little value unless soil fertility also receives attention.

References:—

(1) "Areas Sown to Individual Varieties of Wheat in W.A.; this Journal.
(2) "A Third Factor for Resistance": I. A. Watson and W. L. Waterhouse, "Nature," Feb. 17th, 1945.
(3) "The Combination of the Stem Rust Resistance Genes from the Wheats Eureka and Warigo," Pugsley and Phipps. *Jnl. Aus. Inst. Ag. Sc.*, Vol. IX., pp. 130.
(4) "Breeding for Bunt Resistance in Australian Wheats": A. T. Pugsley, *Jnl. Aus. Inst. Ag. Sc.*, Vol. IX., No. 1, March, 1945.
(5) "Varietal Resistance of Wheat to Loose Smut": A. T. Pugsley, *Jnl. Aus. Inst. Ag. Sc.*, Vol. IX., pp. 86.
(6) "The Influence of Some Crop Rotations and Fertilisers on the Strength of Wheat in Western Australia; this Journal.

Ajax.—A cross between Canberra and Hard Federation, made by D. J. Plowman at Parkes, New South Wales; named in 1928.

Amity.—A cross between Peace Hybrid and Bald Early, made by the Department of Agriculture, Victoria; named in 1930 by Mr. Pye, Dookie, Victoria.

Archer.—A tapering, early maturing selection of Baldmin, made by the Department of Agriculture, Victoria; named in 1929.

Archon.—A cross between Bald Early and Minister, made by the Department of Agriculture, Victoria; bred and named by Mr. Pye in 1929.

Badham.—(See Narellan.)

Bena.—A selection from a natural cross of Hard Federation (and probably Marshall's No. 3), made by J. T. Pridham, at Cowra Experiment Farm, New South Wales; named in 1924.

Mid-season; mid-tall; strong straw; brown, tapering, tip-awned ear; large white, soft grain of weak flour class. A very prolific variety under good conditions, but susceptible to flag smut and stem rust.

Bencubbin.—Bred at the Merredin Research Station from a cross between Gluyas Early and Nabawa, made by E. J. Limbourn in 1922. Released in 1929, Bencubbin rapidly replaced Nabawa as the leading midseason variety, firstly in Western Australia and later in other States. In 1941, Bencubbin was the most extensively grown variety in Australia.

In extensive yield trials in Western Australia over a ten year period, Bencubbin outyielded Nabawa by about 12-14 per cent. The straw strength of Bencubbin is intermediate between the parents and it differs from Nabawa also in respect to the shape of the lower outer glumes. In Bencubbin the outer glumes are all uniform but in Nabawa the shoulders of the lower ones are usually rounded. It is highly resistant to flag smut but not to rust. Flour strength is slightly lower than that of Nabawa.

Bobin.—A cross between Thew and Steinwedel, made by J. T. Pridham at Cowra Experiment Farm, New South Wales; named in 1925; early maturing. Susceptible to flag smut and stem rust.

Bogan.—A cross between Bunge and Canberra, made by G. S. Plowman, a farmer, at Parkes, New South Wales; named in 1926. Susceptible to flag smut.

Boomey.—A selection from departmental cross of Yandilla King and Zaff-Gullen made about 1930 by J. W. Eade, farmer, Euchareena, New South Wales.

Early; short, weak, fine straw; brown tapering, awned ear; white, translucent grain. Highly resistant to flag smut, susceptible to stem rust.

The flour is of medium to poor baking strength, much lower than would be inferred from its hard textured grain.

Brown Colonel.—A natural cross of Colonel (Bull. 72), selected by H. Pye at Dookie Agricultural College about 1925.

Brown Joffre.—A natural cross of Joffre (Bull. 72), selected by H. Pye at Dookie Agricultural College about 1925.

Brown Minister.—A natural cross of Minister, selected by H. Pye at Dookie Agricultural College about 1925.

Bundar.—A cross between Bunyip and Forelock, made by the Department of Agriculture, New South Wales; named in 1932. Moderately resistant to flag smut.

Bungulla.—A very early maturing selection from Bencubbin, made by A. J. Millington at Merredin Research Station, Western Australia, in 1934; named in 1939.

Morphologically similar to Bencubbin. Highly resistant to flag smut. Well suited to dry districts, it has, because of its superiority in respect to yield, straw strength and flag smut resistance, replaced Noongaar in Western Australia.

It yields flour of the same strength as Bencubbin.

Burnham.—A selection from Comara (Cowra Burnham), made at Cowra Experiment Farm, New South Wales; named in 1928.

Burrill.—A cross between Hard Federation and Warden, made by D. J. Plowman, farmer, Parkes, New South Wales; named in 1928.

Mid-season; tall, fine, weak straw; white, tapering, rather lax, tip awned ear; white, soft grain of weak flour quality. Susceptible to flag smut, moderately resistant to stem rust.

Grown on small areas in the central districts of New South Wales for a few years after its distribution in 1928.

Cadet.—A tapering selection of Major bred and named by Mr. Pye, Dookie Agricultural College, Victoria; named in 1929. Grown in New South Wales.

Another wheat of same name is a sister wheat to Cad.

Calare.—A cross between Federation and Canberra, made by the Department of Agriculture, New South Wales; named in 1929.

Susceptible to flag smut and to stem rust.

Camira.—A cross between Major and Thew, made by the Department of Agriculture, New South Wales; named in 1929. Susceptible to flag smut.

Canton.—A cross between (Canberra x Hard Federation) and Clarendon, made by the Department of Agriculture, New South Wales; named in 1932.

Carlisle.—A cross between Bald Early and Minister, made by H. Pye at Dookie Agricultural College, Victoria; named in 1930.

Mid-season; medium short, medium strong straw; white, tip-awned, dense, club-tipped ear; white generally hard grain yielding a medium strong flour. Very susceptible to flag smut and to stem rust.

Castor.—A cross between (Indian 8 x Telford) and Marshall Foch, made at Dookie Agricultural College, Victoria; named in 1930.

Celebration.—Double Cross x Dundee x Dundee is derived from a cross made at Glen Innes, the Double Cross parent being a sister line of Thatcher (Marquis x Kanred x Marquis x Iumillo).

It has a lax tapering smooth brown head with a medium tip beard. Straw is about equal to that of Ford in height and strength.

Grain is frequently vitreous and in baking quality it can be considered an improvement on Dundee but it is scarcely equal to Eureka in gluten stability.

It is highly resistant to flag smut and stem rust (including the biotype of Race 34 to which Eureka is susceptible).

Maturity is approximately equal to Ford. It is as a stem rust resistant wheat for early sowing that this strain is recommended.

Charter.—Released in 1944 by the New South Wales Department of Agriculture. Bred by S. L. Macindoe from a cross made at the Glen Innes Experiment Farm in 1931, between a selection of Kenya C3040, resembling C6042 in rust reaction, and Gular.

The maturity is early to mid-season. Highly resistant to all Australian races of stem rust and to flag smut. The straw is tall and though of good quality it is apt to lodge when yields are high.

Grain mottles less than Eureka and is of better flour strength, reaching the premium class. It is often a little harsh to mill.

Cilia.—A cross between Gallipoli and Velvet Chaff D, made by H. Pye, Dookie Agricultural College, Victoria; named in 1929. Moderately resistant to flag smut and to stem rust.

Clan.—A cross between Currawa and (Federation x 129 SP/17), made by H. Pye, Dookie Agricultural College, Victoria; named in 1929. Moderately resistant to flag smut and stem rust.

Clarity.—A cross between Hard Federation selection and Clarendon, made by the Department of Agriculture, New South Wales; named in 1935.

Early mid-season; medium tall, strong straw; crown tapering tip-awned ear; white translucent grain. Moderately resistant to flag smut, susceptible to stem rust. The flour strength is slightly superior to Bencubbin.

Clifton.—(Altered to Hunter.)

Climax.—Reputed to be selection from Geeralying. Selected at Nukarni, Western Australia, by Mr. W. H. Cockram. Resistant to flag smut.

Collection.—A cross between Federation and (Federation x College Eclipse), made at Roseworthy Agricultural College, South Australia; named in 1933.

Cookapoi.—A cross between Bunge and Canberra, made by G. S. Plowman, farmer, Parkes, New South Wales; named in 1925. Moderately resistant to flag smut. Very early maturity.

Cowman.—A cross between Gullen (Cowra 24) and Hortus, made by H. Pye at Dookie Agricultural College, Victoria; named in 1929.

Curate.—A cross between Rector and Geeralying, made by H. Pye, Dookie Agricultural College, Victoria; named in 1930.

Curramin.—A cross between Currawa and Minister, made at Dookie Agricultural College; named in 1930.

Moderately resistant to flag smut.

Curran.—A cross between (Comeback x (Minister x Brown Currawa)) made by H. Pye at Dookie Agricultural College, Victoria; named in 1929. Highly resistant to flag smut.

Currawa.—A cross between (Northern Champion x Cretan) x Little Club, made by H. Pye at Dookie Agricultural College; named in 1910. Late; short, weak, coarse straw; white club-tipped, tip-awned ear; white, soft grain of weak flour quality. Moderately resistant to flag smut.

Dalton.—A cross between Dan and Sultan, made at Roseworthy Agricultural College, South Australia; named in 1933. Highly resistant to flag smut.

Danly.—A cross between Dan and Gluyas made at Roseworthy Agricultural College, South Australia; named in 1933. Highly resistant to flag smut.

Dargum.—A cross between Bomen and Red Russian Selection, made by the Department of Agriculture, N.S.W.; named in 1927. Moderately resistant to flag smut (originally Garah).

David.—A cross between Federation and 227 SP/17, made at Dookie Agricultural College, Victoria; named in 1929. Moderately resistant to flag smut.

Deakin.—A cross between Gallipoli and Federation, made at Dookie Agricultural College, Victoria; named in 1929. Moderately resistant to flag smut.

Donna.—A cross between Yeoman and a composite crossbred (Dart's Imperial x Genoa) x (Major x Minister), made at Dookie Agricultural College, Victoria; named in 1930.

Dookie Beta.—A cross between Federation and Bobs (Bull. 72), made by H. Pye at Dookie Agricultural College, Victoria; named in 1928.

Dookie Gamma.—A cross between Federation and Bobs (Bull. 72), made by H. Pye at Dookie Agricultural College, Victoria; named in 1928.

Similar history and breeding to Dookie Beta, but has brown slightly tapering, tip-awned ears. Moderately resistant to flag smut.

Dundee.—A cross between (Hard Federation x Cleveland) and Sands, made by J. T. Pridham at Cowra Experiment Farm, N.S.W., in 1919; named in 1927. Mid-season maturing. The baking quality of the flour is moderately good although under relatively slow ripening conditions the grain is very liable to mottle reducing its quality to the weak flour class. Moderately resistant to flag smut, susceptible to stem rust.

Durity Brown.—A cross between Nobby and Federation, made at Dookie Agricultural College, Victoria; named in 1929.

Durity White.—A cross between Nobby and Federation (Bull. 72), made at Dookie Agricultural College, Victoria; named in 1929.

Eureka I.—A cross between a first generation crossbred (Kenya x Florence) and Dundee, made in 1932 by S. L. Macindoe at New England Experiment Farm, Glen Innes; named and distributed in 1938. (The Kenya parent is the stem rust resistant Kenya crossbred C6040, obtained from Kenya Colony in 1930. Since 1942, this, like Eureka, has been susceptible to a new biotype of Race 34 in N.S.W.)

Medium early maturing; early growth semi-erect, foliage drooping; tillering capacity medium; straw short to medium tall, medium coarse, strong; ear brown, oblong, medium dense, carries short awns (¼ inch to ½ inch long)on the upper spikelets; spikelets glabrous, spreading, fairly regularly arranged; outer glumes of medium length, medium wide with rather square shoulders; lateral nerve and tooth distinct, beak short, acute, and medium broad; grain white, vitreous, but mottled, with rounded cheeks and a shallow crease. The flour is of very good baking quality. Occasionally grain shatters.

Moderately resistant to flag smut; highly resistant to the normal Race 34 of stem rust, but susceptible to a new biotype of Race 34, which is prevalent in N.S.W.

In N.S.W. this variety is referred to as Eureka.

Eureka II.—A selection from the same cross as Eureka; of mid-season maturity with stronger straw and with a somewhat denser and bolder head; holds grain more firmly than Eureka I.

Named and distributed to N.S.W. farmers in 1939, it has the same reaction to stem rust as Eureka I. The grain is normally translucent but mottles badly under favourable ripening conditions. The flour strength is almost premium strong, as is the case of Eureka. In W.A., this variety is distributed to farmers as Eureka.

Federation.—In a row of Improved Fife sown at Lambrigg in 1894, Farrer observed an earlier maturing stranger with purple straw which he called 14A. This plant was probably a true Purple Straw wheat. Without identifying it or knowing anything more of it than its maturity and excellent appearance, Farrer

crossed it the following year with Yandilla, which was of the parentage Improved Fife x Etawah (an Indian wheat). At this time, Farrer was chiefly concerned with breeding wheats possessing the high baking quality of the Fife wheat from Canada, and he was somewhat disappointed with the particular selection of the cross (14A x Yandilla A) from this standpoint, but he kept this brown-eared selection because of its very plump grain, and in 1901 decided to name the strain Federation. In this cross also Farrer had the objective of producing a variety with short, strong, straw, especially suitable for the Australian method of harvesting with the stripper. Susceptible to flag smut and to stem rust.

Fedilla.—A cross between Federation and Yandilla King, made by the Department of Agriculture, Victoria; bred and named by Mr. Pye, Dookie Agricultural College, Victoria; named in 1928.

Fedtail.—A cross between Federation and Australian Talavera, made at Dookie Agricultural College, Victoria; named in 1927.

Fedweb I.—A late maturing variety developed by Dr. W. L. Waterhouse of Sydney University from a cross between the rust resistant American variety Webster and Federation, made in 1926. Although resistant to flag smut and stem rust, Fedweb I. is too late maturing for extensive cultivation. The flour strength approaches premium strong and the grain has excellent milling characters.

Fedweb III.—Similar to Fedweb I. but of very low flour strength.

Flamen.—A cross between (College Eclipse x Atalanta) x Marshall's No. 3A and Queen Fan, made at Roseworthy Agricultural College, S.A.; named in 1916.

Also a cross between (Rector x Major) and Yandilla King, made at Dookie Agricultural College, Victoria; named in 1930.

Florina.—A selection from Florence, made by Mr. P. McD. Smyth of Salters Springs, South Australia.

Ford.—A cross between (Fan x Comeback) and (Zealand x Tardent's Blue) made by W. J. Spafford in 1911 at Roseworthy Agricultural College, South Australia. Mr. R. C. Scott was responsible for the selection and fixation of this wheat. It was named in 1916. Moderately resistant to flag smut and to stem rust.

Free Gallipoli.—Dr. A. E. V. Richardson was responsible for the production of Gallipoli wheat, a cross between a Club wheat and Yandilla King, which was distributed to farmers in 1917. This variety proved tough to strip, but as it was not quite fixed in this character, Mr. G. S. Gordon, at Werribee Research Farm, Victoria, selected in 1917 a strain that stripped readily. This was named Free Gallipoli in 1925 and distributed to farmers in 1926. Highly susceptible to flag smut and to stem rust.

Frisco.—(Kenya x Florence x Dundee) Gular; this cross was made at Glen Innes, N.S.W.

It is an early to mid-season wheat, being a few days ahead of Eureka at ear emergence. The straw is normally moderately short and strong but occasionally shows some indication of the Gular type of weakness. Head is smooth, brown and square with a moderate tip awn.

The rather dark amber grain is usually more vitreous, fuller and of higher bushel weight than that of Gular, although it is rather narrow in shape.

In baking quality this strain has good stability and strength, but under dry conditions the gluten is likely to become harsh. It is resistant to flag smut and is susceptible to those strains of stem rust to which Eureka is susceptible.

Gabo.—A wheat bred at Sydney University from a cross made in 1936 between a selection of Bobin and a durum wheat Gaza, which yielded a slightly fertile hybrid which next year was back-crossed to the Bobin selection.

Gabo is an early-maturing wheat, strongly resistant to all races of stem and leaf rusts known to occur in Australia. It has short, strong straw; strong tip-beard and light coloured chaff. It has proved drought-resistant in several seasons. The grain is small and has maintained high milling and baking qualities when grown under differing climatic conditions.

Garah.—Altered to Dargum.

Ghurka.—A cross between Gallipoli and a first generation crossbred Currawa x (Indian H. x Federation), made by G. S. Gordon at Werribee Research Farm, Victoria, in 1916; named in 1924. Mid-season to late maturing. The baking quality of the flour is of the weak class. Highly resistant to flag smut; moderately resistant to stem rust.

Gladys.—A supposed hybrid between Bunyip wheat and Imperial Barley, made at Dookie Agricultural College, Victoria; named in 1930.

Glencoe.—Altered to Maldon and again altered to Merven.

Gluclub.—A club headed variety distributed in limited quantities about 1924-25 by Mr. Chas. Smith of Yarding, Western Australia. Susceptible to flag smut and rust, it yields flour of low strength and tends to shed when the crop is heavy.

Gluwari.—A selection from Gluyas with stronger straw, made by Dr. I. F. Phipps, Waite Institute, South Australia; named in 1939.

Gluyas.—In 1894, Mr. H. J. Gluyas, farmer, of Port Germein, South Australia, selected eight or nine types from a field of Ward's Prolific wheat, finally retaining two which showed marked drought resistance. These he named Early Gluyas and Gluyas Dark Straw. The latter was not grown to any extent, and for many years has been out of cultivation. The other variety, now known as Gluyas Early, or Gluyas, became one of the most important wheats in Australia. The baking quality of the flour is weak. Susceptible to flag smut, but has a moderate resistance to stem rust; yields well under dry conditions.

Gowan.—A cross between Currawa x (Minister x 226 SP/17), made at Dookie Agricultural College, Victoria; named in 1929.

Gunyah.—A cross between a Bunyip selection (110) and Marshall's No. 3, made by G. S. Plowman, farmer, Parkes, New South Wales; named in 1928.

Early; medium tall, medium strong straw; brown, tapering tip-awned ear; white, medium hard grain of weak flour quality.

Susceptible to flag smut and to stem rust.

Grown by a few farmers in the Parkes district for a few years after its distribution in 1930.

Hofed 1.—A cross between the American variety Hope and Federation, made by Dr. W. L. Waterhouse at Sydney University, New South Wales, in 1926; named in 1937.

Highly resistant to stem rust, and resistant to flag smut.

Distributed to farmers in the north-west districts of New South Wales in 1938.

Yields a flour of medium strength.

Hume.—A cross between Jonathan x (Sunset x Jeff) and Felix, made by the Department of Agriculture, New South Wales; named in 1936. Susceptible to stem rust and flag smut.

Hunter (Clifton).—A cross between Clarendon and Forelock, made by the Department of Agriculture, New South Wales; named in 1929.

Ideal.—A cross between the Canadian variety Marquis and Comeback, made by W. H. Scholz, farmer, Gilgandra, New South Wales; named in 1932.

Inmarsh.—A cross between Indian King and Marshall's No. 3, made at Dookie Agricultural College, Victoria; named in 1928.

Javelin.—A cross between Onas and Nabawa, made at Roseworthy Agricultural College, South Australia, in 1930. Selected by E. J. Breakwell and released as a variety in 1942. It is mid-season maturing and resistant to flag smut but not stem rust. The straw is of medium height and good strength. Flour approaches premium strength.

Joppa.—A durum variety introduced from Palestine by the Department of Agriculture, New South Wales.

Mid-season; medium tall, medium strong straw; white, dense ear, long black awns; large grain suitable for macaroni manufacture.

Grown by individual farmers in New South Wales since 1938 for macaroni.

Junto.—A cross between Federation and Nabawa, made at Dookie Agricultural College, Victoria; named in 1929.

Kara.—A cross between (Firbank x (Comeback x Minister)) and Bald Early, made at Dookie Agricultural College, Victoria; named in 1929.

Kendee.—A wheat bred at Sydney University from a cross made in 1934 between Dundee and Kenya (S.U. Accession No. 745).

Kendee is a mid-season wheat, strongly resistant to all races of stem rust known to occur in Australia and to flag smut.

It has strong straw, slight tip-beard and white chaff. The grain is of medium size and falls in the medium-strong flour class.

Kington.—A cross between Yandilla King and Sultan, made at Roseworthy Agricultural College, South Australia; named in 1933.

Koala.—A cross between Hard Federation and Nabawa, made at Wagga Experiment Farm, New South Wales, in 1928; named in 1936.

Early; medium short strong straw; white, oblong, tip-awned ear; white, horny grain. Only moderately resistant to flag smut; susceptible to stem rust.

The flour strength is of medium quality.

Kondut.—Released in 1943 by the Western Australian Department of Agriculture, Kondut is derived from a cross made between Wilfred and Sutton at the Chapman Research Station in 1932 by D. R. Bateman. Medium, tall growing with stout straw and white glumes, Kondut, although soft grained usually yields flour of better strength than the West Australian f.a.q. Mid-season in maturity, Kondut is resistant to flag smut and is less susceptible in the field to stem rust than are Bencubbin and Nabawa.

Koongi.—A cross between Powman's No. 110 and Marshall's No. 3, made by G. S. Plowman, farmer, Parkes, New South Wales; named in 1928.

Koorda.—Originated from a cross made at the Merredin Research Station by E. J. Limbourn in 1928 between Nizam and Nabawa.

Early in maturity. Tall growing, stout strawed variety with white glumes and a dense, slightly tapering ear. Grain is of good colour, plump, very attractive and free milling. Although free stripping, it does not shed.

The flag smut resistance of this variety closely approaches total immunity, but it is susceptible to the common stem rust strains. The flour strength is about equal to that of Bencubbin.

Kundi or *Kundy.*—A cross between a selection of Bunyip (Plowman's No. 3) and Canberra, made by G. S. Plowman, farmer, Parkes, New South Wales; named in 1930.

A soft grained wheat of good baking quality.

Lambert.—A cross between Thew and Steinwedel, made by the Department of Agriculture, New South Wales; named in 1929. Susceptible to stem rust.

Loombah.—A cross between Nabawa and Exquisite. This is a late maturing wheat slightly earlier than Yandilla King. It is highly resistant to flag smut, has fairly good medium fine straw, does not shed its grain, and has long ear which is fairly well filled.

Magnet.—A cross between Major and Free Gallipoli W5817 J-2-2-4, made by H. Gordon, Werribee Research Station, Victoria; named in 1939.

Late; medium tall, strong straw; white, awnless ear; white soft grain of poor baking quality.

Susceptible to stem rust and to flag smut.

Designed to replace Free Gallipoli in the Wimmera districts of Victoria.

Major.—A cross between Federation and Wallace, made by H. Pye at Dookie Agricultural College, Victoria; named in 1915. Late; strong, coarse straw; white clubbed, slightly tip-awned ear; white, soft grain of weak flour quality. Susceptible to flag smut and to stem rust.

Maldon (now Morven).—A cross between Canberra and Hudson's Early Purple Straw, made by the Department of Agriculture, New South Wales; named in 1929.

Marathon.—A selection from Ford, made in 1928 by P. McD. Smyth of Salters Springs, South Australia. The maturity is mid-season.

Meenawarra.—A cross between (Bobs x Florence) and Gluyas, made by the Department of Agriculture, Queensland; named in 1939.

Early; medium tall, slightly weak straw; white, tapering, slightly tip-awned ear; white soft grain of medium flour quality. Susceptible to flag smut and to stem rust. Sheds grain slightly.

Grown in the Brookstead centre of the Darling Downs, Queensland, for the last four or five years. The name was officially registered in 1939. Synonym, B.F.G.

Merredin.—Developed at the Merredin Research Station from unfixed material brought to W.A. from N.S.W. where the original cross between Federation and Gluyas was made by R. J. Hurst at Wagga in 1907. Merredin was released as a variety in 1917. The maturity is early and Merredin is susceptible to flag smut and rust.

Merven or Morven.—(See Maldon).

Midas.—A cross between Peace Hybrid and (Queens Jubilee x Australian Talavera) x Federation, made at Dookie Agricultural College, Victoria; named in 1930.

Minflor.—A cross between Minister and Florence, made by H. Pye at Dookie Agricultural College, Victoria; named in 1929.

Very early; short, rather weak straw; white, dense tip awned ear; white, vitreous grain of medium strong baking quality. Highly resistant to flag smut; susceptible to stem rust.

There are two strains of Minflor, one being later than the other and having a club shaped ear at the tip. This strain has been found by the Department of Agriculture, N.S.W., to possess a truly "winter habit" of growth, and experiments are in progress to determine the suitability of this "Winter Minflor" when sown a few months prior to normal sowing time. It has also been used for its "winter habit" in further crosses.

Mitchell.—A cross between Nabawa and Dundee. This variety matures a little later than Bencubbin and Bobin. It is very highly resistant to flag smut, but susceptible to stem rust. It is comparatively short and strong strawed. Under dry conditions it develops a vitreous grain not prone to mottling.

It is medium to strong in baking quality.

Moe.—A cross between Bald Early and Jonathan, made at Dookie Agricultural College, Victoria; named in 1929. (Rather good straw.)

Mona.—A cross between Plowman's No. 3 (Bunyip selection) and Canberra, made by G. S. Plowman, farmer, Parkes, N.S.W.; named in 1933.

Very early; medium strong, rather fine straw; white, tapering, tip awned ear; white, soft grain of weak flour quality.

Highly resistant to flag smut; susceptible to stem rust.

Grown by individual growers in the Central Western districts of New South Wales since 1937 on account of its very early maturity.

Morley.—The result of an attempted hybrid between Major and Volga barley, made by the Department of Agriculture, N.S.W.; named in 1929. Resembles Major, but matures early.

Fairly resistant to stem rust, but susceptible to flag smut.

Mulyan.—A cross between Bunge x Hard Federation, made by G. S. Plowman, farmer, Parkes, N.S.W.; named in 1928. Synonym Plowman's 210.

Nabawa.—A cross between Gluyas Early and Bunyip, which was made in 1908 at Wagga Experiment Farm, New South Wales. Dr. G. L. Sutton took some third generation seed of this cross to Western Australia in 1911, and from this material the variety was fixed at Chapman Experiment Farm and named in 1915. Practically immune to flag smut; slight resistance to stem rust.

Narellan.—A selection from Yandilla King, made by the Department of Agriculture, N.S.W., named in 1928. Was previously "Badham."

Narwonah.—A cross between Plowman's 110 and Hard Federation, made by D. T. Plowman, farmer, Parkes, N.S.W.; named in 1928.

Niska.—A cross between Firbank and Warden, made at Dookie Agricultural College, Victoria; named in 1930.

Nizam.—A cross between Indian 17 and Federation, made by R. S. McTaggart in 1916 at Longerenong Agricultural College, Victoria, named in 1924. Mid-season; short medium-strong straw; brown, dense, awnless ear; white, soft grain of weak flour quality. Susceptible to flag smut and to stem rust.

Noongaar.—A cross between Sunset x Gluyas Early, made at Chapman Experiment Farm, Western Australia in 1917; named in 1926. The selection work was carried out at Merredin by E. J. Limbourn.

Very early maturing. Susceptible to flag smut and to stem rust; stands dry conditions well. Noongaar yields a weak flour and has now been largely replaced by Bungulla.

Noorimbee.—A cross between (White Lammas x Genoa) and Yanward, made at Dookie Agricultural College, Victoria; named in 1929.

Nubrygyn.—A cross between Comeback and Cedar, made by J. W. Eade, farmer, Euchareena, N.S.W.; named in 1934. Hard, vitreous grain of very good flour quality.

Nymph.—A cross between Yeoman and Bald Early, made at Dookie Agricultural College, Victoria; named in 1930.

Orion.—(Originally Arion), a cross between (Indian 8 x Telfords) and Marshall Foch, made at Dookie Agreiultural College, Victoria; named in 1930. Moderately resistant to flag smut.

Penny.—A selection from the English variety Squarehead, made about 1900, by Mr. Penny, a farmer of Green Hills, Western Australia; named about 1900.

Late; tall, strong straw; white, clubbed, dense tip-awned ear; white, soft grain of very weak flour quality. Susceptible to flag smut and stem rust.

Pindar.—Originated from a plant selected from a plot of Ghurka in 1927 by the Government Cerealist (G. S. Gordon) at the State Research Farm, Werribee.

Brown chaffed, tip-awned, fairly compact, slightly tapering head, threshes readily. Straw short to medium length, slightly taller than parent, stands well. The maturity is late. Resistant to flag smut.

Plowman No. 3.—Plowman wheats have been grown experimentally under various numbers. They have all been produced by Messrs. D. T. and G. S. Plowman, farmers, Parkes, New South Wales.

Pollux.—A cross between (Indian 8 x Telfords) and Marshal Foch, made at Dookie Agricultural College, Victoria; named in 1930.

Puglu.—A cross between Pusa 4 and Gluyas, made by R. E. Soutter at Roma State Farm, Queensland; named in 1938, although it was distributed a few years previously under its crossbred name.

Early; medium tall, slightly weak straw; brown, tapering, tip-awned ear; white semi-translucent grain of weak flour quality. Susceptible to flag smut and to stem rust.

Puora.—A cross between Pusa 4 and Flora, made by R. E. Soutter at Roma State Farm, Queensland; named in 1932.

Very early maturing; medium tall, slightly weak straw; white awnless tapering ear; white translucent grain of strong flour quality. Resistant to flag smut; susceptible to stem rust.

Puseas.—A cross between Pusa 4 and C.C.C., made by Mr. R. E. Soutter, at Roma State Farm, Queensland; named in 1939.

Early; medium tall, slightly weak straw; white oblong medium, dense ear; white semi-translucent grain of moderately good baking quality; susceptible to flag smut and to stem rust. Distributed to farmers in Queensland about 1936.

Quadrat.—Originated from a cross between Ghurka and an unnamed crossbred Currawa x (Major x Gallipoli), made in 1927 by the Government Cerealist (G. S. Gordon) at the State Research Farm, Werribee.

Brown chaffed, tip-awned, compact square to clubby head, threshes readily. Straw short to medium length, stands well. Late in maturity.

Disease resistance—Quadrat has shown greater resistance than Ghurka to both flag smut and leaf rust.

Rajah.—A cross between Indian E and Telford's, made at Longerenong Agricultural College in 1912, by I. Tulloh, and selected at Werribee Research Farm, Victoria; named in 1924.

Early mid-season; medium tall, slightly weak straw; white, dense, clubbed, tip-awned ear; white, soft grain of weak flour quality.

Moderately resistant to flag smut, but susceptible to stem rust; moderately drought-resistant.

Ranee.—A cross between Indian F and Federation was made at Longerenong Agricultural College, Victoria, in 1912, by I. Tulloh, second generation seed was sown at the Werribee Research Farm, and selection made by departmental officers under the supervision of A. E. V. Richardson. It was named and distributed in 1924.

The original selection showed a slight variation in regard to the degree of tip awns, and has since been discarded in favour of a more prolific selection made by G. S. Gordon in 1920 and distributed in 1930 as Ranee 4H. The improved strain has now largely taken the place of the old variety. Susceptible to flag smut and to stem rust.

Rapier.—A selection from Sword made by E. J. Breakwell at Roseworthy Agricultural College, South Australia, in 1933; named in 1939. Susceptible to flag smut but moderately resistant to stem rust, the maturity is early and the flour strength medium.

Ridley.—This variety was derived from a cross between Nabawa and Hard Federation, made at the Waite Institute by I. F. Phipps and S. R. Hockley in 1930. The maturity is mid-season, the medium length straw is of good strength and the grain is usually hard and vitreous. Ridley is moderately resistant to flag smut but is susceptible to stem and leaf rusts and to bunt.

Regalia.—A cross between Ranee and Free Gallipoli, made by G. S. Gordon at Werribee Research Farm, Victoria; named in 1938.

Early; medium tall strong straw; brown oblong, slightly tip-awned ear; white soft grain, of weak flour quality. Susceptible to flag smut and to stem rust.

Roma.—A cross between Yeoman and Yuna, made at Dookie Agricultural College, Victoria; named in 1930.

Also a cross between Kings Jubilee and Indian G, made by William Farrer at Lambrigg, New South Wales; named about 1890.

Rubra.—A cross of the parentage ((American Prolific x Late Red) x White Fife) x Marquis, produced at Dookie Agricultural College, Victoria; named in 1930. Red grain, highly resistant to flag smut.

Satisfaction.—A cross between Bayah and Pusa 4, made by W. H. Scholz, farmer, Gilgandra, New South Wales; named in 1927.

Early; short, medium strong straw; brown, clubbed, tip-awned ear. White soft grain of weak flour quality. Moderately resistant to flag smut; susceptible to stem rust.

Scimitar.—Result of a selection made by Messrs. E. J. Breakwell and E. M. Hutton, from a cross between Nabawa x Egyptian 4, made at Roseworthy Agricultural College in 1930.

A mid-season maturing variety. Tillers well, with semi-erect early growth of moderate vigour. The head is white, of medium length; lean and tapering. The glumes are of medium width with round shoulders and a short beak. There is a weak tip awn. The straw is weak and often lodges, but it is willowy and of good quality, combing out well without breaking. The grain is firmly held but threshes readily. Grain is exceptionally hard, bright in colour and plump and yields a strong flour. Susceptible to stem rust, it is resistant to flag smut and has some resistance to leaf rust.

Seafoam.—A cross between (Comeback x Cretan) and Comeback, made by R. E. Soutter at Roma State Farm, Queensland; named in 1930.

Very early; short, weak straw; white, lax, awned ear; white translucent grain of medium strong flour quality. Moderately resistant to flag smut; susceptible to stem rust.

Seaspray.—Selection from Comeback x Cretan x Comeback. A sister wheat to Seafoam; named in 1934.

Very early; medium tall, weak straw; brown tapering, tip-awned ear; white translucent grain of medium strong flour quality.

Seewari.—An early maturing selection from Sepoy, made at the Waite Agricultural Research Institute by Dr. J. Phipps.

Sepoy.—A cross between Currawa and (Indian H x Federation), made by G. S. Gordon in 1913 at the Werribee Research Farm, Victoria; named in 1924.

Late; rather short strong straw; brown clubbed, almost awnless ear; white soft grain of weak flour quality. Susceptible to flag smut and to stem rust.

Sergeant.—Selection from Major.

Stockman.—A cross between Cleveland and Stockton's Defiance, made by the Department of Agriculture, New South Wales; named in 1929. Highly resistant to flag smut.

Strathroy.—Selected from Braemar Velvet in 1933 by Tasmanian Department of Agriculture.

Sturt.—A selection from Sands, made by the Department of Agriculture, New South Wales; named in 1937. Resistant to flag smut.

Sutton.—A cross between Nabawa and Carabin, made by E. J. Limbourn at Merredin Experiment Farm, Western Australia, in 1923; selected and fixed at Chapman Experiment Farm by D. R. Bateman; named in 1930.

Late; tall, strong straw; white tapering, tip-awned ear; white, soft grain. Highly resistant to flag smut, susceptible to stem rust.

Sword.—A cross between Sultan and Ford, made by R. C. Scott in 1920, at Roseworthy Agricultural College; named in 1923. Susceptible to flag smut; moderately resistant to stem rust.

Talbot.—Parentage 552 SP/17 x 102 SP/17. Made at Dookie Agricultural College, Victoria; named in 1929.

Tamar.—A cross between Hurst's 4 and Roseworthy, made by the Department of Agriculture, New South Wales; named in 1930. Susceptible to flag smut.

Ula.—A cross between Bogan and Geeralying, made by G. S. Plowman, Parkes; named in 1936.

Ulan.—A cross between Bunge and Hard Federation, made by G. S. Plowman, farmer, Parkes, New South Wales; named in 1929.

Wandi.—A cross between a Bunyip selection (Plowmans No. 3) and Canberra, made by G. S. Plowman, farmer, New South Wales; named in 1926.

Waratah.—A cross between Hudson's Early Purple Straw and Gluyas, made by R. J. Hurst at Wagga Experiment Farm, New South Wales; selected by J. T. Pridham and R. J. Hurst and named in 1921. Susceptible to flag smut and to stem rust.

Waria.—A cross between Gluyas and Hard Federation, by Dr. I. F. Phipps at Waite Research Institute, South Australia; named in 1938.

Warigo.—A cross between Nabawa and Hope, made by Dr. I. F. Phipps at Waite Research Institute, South Australia in 1931. Released as a variety in 1941, Warigo possesses mature plant resistance to stem rust and is highly resistant to flag smut, loose smut, leaf rust and mildew. It has white translucent grain yielding flour of good baking quality.

Warput.—A cross between Pusa 4 and Warren, made by Mr. R. E. Soutter at Roma State Farm, Queensland; named in 1930.

Medium late; medium tall weak straw; white tapering, awnless ear; white grain of medium strong flour class. Susceptible to flag smut; moderately resistant to stem rust.

Waugan.—A cross between Bunge and Canberra, made by Mr. G. S. Plowman, farmer, Parkes, New South Wales; named in 1924.

Very early; medium tall, medium strong straw; white, tapering, tip-awned ear; white soft grain of weak flour quality.

Woodie.—A selection made by Mr. Brook, farmer, of Woodchester, South Australia, in 1933 from a crop of Boomey.

Yabba.—A cross between (Currawa x Kings Early) and (Federation x German 12), made at Dookie Agricultural College, Victoria; named in 1929.

Yalta.—The cross Kenya x Pusa 4 x Dundee was made at Glen Innes, New South Wales. It was named in 1945.

This is a mid-season wheat about equal to Eureka in maturity, i.e., it is several days earlier than Dundee or Ford. Straw is of medium height and of good quality. The square creamy head has a large tip awn and pubescent chaff, which allows it to be readily distinguished from other commercial varieties. Under certain ripening conditions the tip awns become a dark grey or dun colour which makes the variety very easy to recognise.

The rather small and darkish amber grain is plumper, more vitreous and stronger than that of Eureka. Baking quality places the wheat in the premium class.

It is highly resistant though not immune to flag smut, but susceptible to leaf rust in the field. Resistant to the normal rust Race 34 and to the biotype to which Eureka is susceptible.

Yandilla King.—A cross between Yandilla and Silver King, made by Mr. R. Marshall, farmer, Warmby, South Australia; named in 1907.

Late; prostrate early growth; medium-tall, strong straw; white, tapering, long slightly tip-awned ear; white, soft grain of weak flour quality. Susceptible to flag smut and to stem rust.

Yok.—A sister wheat to Canimbla, selected at Glen Innes Experiment Farm, New South Wales; named in 1930. The parentage is Hard Federation x Cleveland.

Yokel.—A cross between Collin and (Yeoman x Bald Early), made at Dookie Agricultural College, Victoria; named in 1930.

Yetna.—A cross between Fortune and Gluyas Early (Type 11), made by Department of Agriculture, Western Australia; named in 1925. Susceptible to flag smut.

Zulu.—A cross between Red Cap and Giant, made at Dookie Agricultural College; named in 1929. A durum wheat.

Areas Sown to Individual Varieties of Wheat in Western Australia.

L. W. Samuel, Cereal Research Officer.

In the September, 1944, issue of this Journal was published data showing the areas sown in Western Australia to individual varieties of wheat that were or had been prominent in this State from the 1925-26 season to the 1941-42 season. Owing to wartime conditions this information was not collected by the Government Statistician for the season 1942-43 but was resumed in 1945 with the details of the areas sown in the 1944-45 season and the areas proposed to be sown in the 1945-46 season.

For these two seasons farmers named 112 varieties, but 100 of these varieties were sown to less than 15,000 acres each. The leading three varieties account for some 70 per cent. of the total area sown to wheat for all purposes, grain, hay, and green fodder, compared with 62 per cent. for the leading three varieties in the 1941-42 season.

The accompanying table shows the leading 12 varieties sown in the 1944-45 season and proposed to be sown in the 1945-46, together with the areas sown to these varieties in the 1941-42 season for comparison.

There has been only one major change in popularity, namely, the increase in the area sown to Bungulla, the new variety recently released by the Department of Agriculture, Western Australia. This variety is an early maturing selection from Bencubbin and appears to be replacing Noongaar mainly as this latter variety has receded from fourth place in the 1941-42 season to twelfth and tenth place respectively in the 1944-45 and 1945-46 seasons.

In the proposed sowings for the 1945-46 season Bungulla occupies third place with practically one-seventh of the total area to be sown.

The leading varieties, Bencubbin and Gluclub have maintained their positions and it may be noted that Bencubbin is also the most popular variety in New South Wales, where preliminary figures show it to be sown to 1,543,504 acres, or 40.5 per cent. of the total area for the 1945-46 season.

It is of considerable interest that under the compulsory restriction of wheat acreages due to war conditions the relative popularity of the different varieties of wheat remained comparatively unchanged.

AREAS SOWN TO INDIVIDUAL VARIETIES OF WHEAT IN WESTERN AUSTRALIA.

Sown for Grain, Hay, and Green Fodder.

Season.	1941–42.			1944–45.			1945–46.		
	Order.	Area.	Per cent. of Total.	Order.	Area.	Per cent. of Total.	Order.	Area.	Per cent. of Total.
Variety.		acres.			acres.			acres.	
Bencubbin ...	1	998,564	35·6	1	666,184	39·2	1	736,281	37·8
Gluclub ...	2	579,405	20·7	2	340,074	20·0	2	361,586	18·6
Bungulla ...	12	40,666	1·5	3	185,602	10·9	3	276,158	14·2
Merredin ...	3	169,314	6·0	4	84,389	5·0	4	95,021	4·9
Ranee ...	5	120,290	4·3	5	73,717	4·3	5	87,081	4·5
Nabawa ...	7	96,443	3·4	6	41,987	2·5	7	41,630	2·1
Waratah ...	10	61,301	2·2	7	36,794	2·2	6	41,907	2·1
Dundee ...	6	115,200	4·1	8	28,727	1·7	8	29,231	1·5
Ford	11	42,672	1·5	9	26,905	1·6	9	26,988	1·4
Baroota Wonder	16	30,349	1·1	10	24,191	1·4	12	23,395	1·2
Gluyas Early	8	85,443	3·0	11	24,011	1·4	11	24,208	1·2
Noongaar ...	4	130,691	4·7	12	22,419	1·3	10	26,888	1·4
Other... ...	...	403,726	14·5	...	144,327	8·5	...	177,051	9·1
Totals ...	...	2,803,049	100·0	...	1,699,327	100·0	...	1,947,425	100·0

The Influence of Some Crop Rotations and Fertilisers on the Strength of Wheat in Western Australia.

L. W. Samuel, Cereal Research Officer.

SUMMARY AND CONCLUSIONS.

During 1944 a number of experiments were carried out at the research stations of the Department of Agriculture to test the effect of fertilisers and crop rotation on the yield of wheat. Samples of the harvest of these experiments have been tested for the "strength" of the wheat as measured by the Farinograph, the Pelshenke test and gluten content.

The results obtained are for one season only but show:—

1. The strength of the wheat was not affected by the rate of application of superphosphate at any of the four research stations.

2. A similar result was obtained from the "residual" superphosphate experiment at three of the research stations but at the fourth, Chapman Research Station, there was evidence that the use of superphosphate had reduced the strength.

3. The strength of the wheat was not affected by the different types of phosphatic fertiliser used in experiments at two of the research stations.

4. At the Merredin Research Station each of two varieties of wheat grown from seed from other research stations showed that change of seed (true to type and purity) did not affect the strength.

5. The rotation experiment at three research stations gave differing results from each station, though at each station an increase in strength was obtained by the introduction of one or more courses in the rotation.

6. At the Merredin Research Station the use of fertiliser containing molybdenum decreased the strength but when several "minor" elements were used as distinct from only one (molybdenum) there was a marked increase in strength.

MATERIALS AND METHODS.

The wheat samples used in this investigation were grown at four of the research stations of the Department of Agriculture distributed throughout the wheatbelt of Western Australia.

(a) Chapman Research Station, located north-east of Geraldton at the northern end of the wheatbelt.

(b) Merredin Research Station situated about 160 miles approximately east of Perth in the middle of the wheatbelt.

(c) Salmon Gums Research Station, some 70 miles north of Esperance in the south-east corner of the State.

(d) Wongan Hills Research Station, some 120 miles approximately north-east of Perth. This research station differs from the other three in that it is specifically located on very light land, the soils for the most part being sands or gravelly sands.

The rainfall at the various stations during 1944 is shown in the accompanying table:—

RESEARCH STATION RAINFALL (POINTS).

Station.	Jan.	Feb.	Mar.	Apl.	Growing Period							Nov.	Dec.	Total.
					May.	June.	July.	Aug.	Sept.	Oct.	Total.			
Chapman, 1944	....	....	36	52	250	226	542	203	46	....	1,267	29	42	1,426
Average	29	39	70	74	234	419	383	266	150	89	1,553	35	26	1,817
Merredin, 1944	21	....	25	15	263	75	287	172	47	6	850	....	24	935
Average	47	60	100	92	134	188	178	149	82	80	811	42	62	1,214
Salmon Gums, 1944	18	1	11	89	275	44	142	120	57	51	689	29	56	893
Average	99	78	163	92	126	143	144	156	90	121	780	95	83	1,391
Wongan Hills, 1944	3	....	21	19	249	131	374	193	40	14	1,001	7	40	1,091
Average	40	52	106	91	187	250	247	196	91	75	1,050	42	40	1,429

The cultural details and yield results of some of the experiments have already been published in this Journal, Millington and Langfield (1945), Teakle (1945).

The tests used to evaluate the strength of the wheat samples were the wholemeal fermentation time or Pelshenke test and the Farinograph, previously described, Samuel (1938), the wheat being milled on a Brabender experimental mill;

and the gluten test which consisted of making a dough from a weighed amount of flour and kneading this by hand in running water until all the starch was washed away and the soft rubbery gluten was left. The surplus water was removed, the wet gluten weighed, dried and re-weighed.

The strength factors reported are:—

1. Wholemeal fermentation time or Pelshenke time. The longer the time in minutes the stronger the wheat.

2. Farinograph—

(a) Water absorption calculated on the basis of 13.5 per cent. moisture in the flour. The water absorption of a flour is not a good measure of strength but is commercially important because the higher the water absorption the greater the amount of bread produced per sack of flour.

(b) The Farinograph strength figure, the time in minutes from the commencement of mixing until the top of the graph falls below the level of the mid-point of the graph at maximum consistency. The greater the strength figure, the stronger the flour.

3. Dry gluten percentage.— Since the amount of wet gluten is normally about three times the amount of dry gluten, only dry gluten contents are reported. The strength of a flour depends on both the quantity and the quality of the gluten. There is as yet no adequate method of measuring the quality of gluten but in these experiments the same wheat variety was grown in all treatments within each field trial so that it is valid to assume that the quality of the gluten has remained constant and thus the quantity of gluten is a measure of the strength of the flour. This assumption is confirmed by the results of the minor element trial and the rotation experiment described later.

EXPERIMENTAL RESULTS.

1. Rate of superphosphate experiment.

This experiment has been conducted at the research stations for a number of years. The plots are planted in two sections, the first using rates of nil, 75 lb. and 150 lb. per acre and the second 150 lb., 225 lb. and 300 lb. per acre of 22 per cent. superphosphate. The 150 lb. per acre is regarded as the control.

Because of the lower grade of superphosphate available during the war years the rates have been increased to maintain a constant application of phosphate.

The results of the examination of the grain for strength are shown in Table 1, and none of the strength factors show an appreciable variation with changes in the rate of application of superphosphate.

2. Residual superphosphate experiment.

This experiment was designed to measure the effect on the growth of wheat of the residual superphosphate in the soil after repeated applications in past seasons. This information was required to make the most efficient use of the reduced amounts of superphosphate available during the war.

Table 2 shows the results of the strength tests of the grain from this experiment and confirms the rate of application of superphosphate experiment that the

quantity of superphosphate used has not materially affected the strength of the wheat except at the Chapman Research Station where there is evidence of a reduction in strength with increase in the rate of application of superphosphate.

Table 1.

RATE OF APPLICATION OF SUPERPHOSPHATE AND THE STRENGTH OF WHEAT.

Rate.	Farinograph.		Dry gluten.	P.T.	Yield. Per cent. of Control.	
	W.A.	S.F.			1944.	Average.
Chapman Research Station—Variety: Nabawa.						
lb. per acre	%		%	(mins.)		(16 yrs.)
0	52·1	2·1	(*a*)	25	96	84
92	52·8	2·4	(*a*)	25	94	96
183	52·7	2·5	(*a*)	24	100	100
183	52·1	2·4	5·1	26	100	100
275	52·5	2·9	6·0	25	96	100
366	52·4	2·4	(*a*)	26	103	103
Merredin Research Station—Variety: Bencubbin.						
lb. per acre	%		%	(mins.)		(13 yrs.)
0	58·1	6·5	10·8	53	66	63
92	58·2	5·5	10·0	55	99	95
183	60·1	5·7	10·4	50	100	100
183	60·3	7·0	11·0	56	100	100
275	60·0	6·7	10·4	56	106	101
366	59·2	5·9	10·3	47	107	102
Salmon Gums Research Station—Variety: Bungulla.						
lb. per acre	%		%	(mins.)		(16 yrs.)
0	59·5	3·8	9·0	38	66	49
92	59·0	4·1	9·4	37	89	89
183	59·5	4·0	9·7	37	100	100
183	58·4	4·9	9·8	37	100	100
274	58·4	4·1	9·9	35	102	104
367	57·0	4·8	9·8	37	110	105
Wongan Hills Research Station—Variety: Bencubbin.						
lb. per acre	%		%	(mins.)		(15 yrs.)
0	56·0	3·7	7·5	31	19	20
92	56·5	3·9	7·6	36	83	82
183	55·5	3·4	6·6	31	100	100
183	54·8	3·0	6·5	34	100	100
275	56·0	3·1	6·7	32	114	103
366	54·8	3·1	6·2	32	117	105

(*a*) No gluten was obtainable as it dispersed during washing.

W.A.—Water absorption on a 13·5 per cent. moisture basis.
SF.—Strength figure.
P.T.—Pelshenke time.

Table 2.

RESIDUAL EFFECT OF SUPERPHOSPHATE AND STRENGTH.

Rate.	Farinograph.		Dry gluten.	P.T.	Yield. Per cent. of Control.	
	W.A.	S.F.			1944.	Average.
Chapman Research Station—Variety: Nabawa.						
lb. per acre	%		%	(mins.)		(3 yrs.)
0	54·5	4·5	7·2	28	72	92
68	54·0	2·7	5·9	28	84	99
137	53·9	2·7	(*a*)	27	100	100
Merredin Research Station—Variety: Bencubbin.						
lb. per acre	%		%	(mins.)		
0	59·3	7·0	11·0	59	87	86
62	58·5	6·7	10·9	57	94	96
133	57·7	6·5	10·6	59	100	100
Salmon Gums Research Station—Variety: Bungulla.						
lb. per acre	%		%	(mins.)		
0	58·2	4·2	8·8	43	93	83
68	59·1	4·3	9·4	39	98	97
137	59·0	3·9	8·8	36	100	100
Wongan Hills Research Station—Variety: Bencubbin.						
lb. per acre	%		%	(mins.)		(4 yrs.)
0	55·6	4·2	6·6	38	68	64
68	55·7	4·0	6·5	35	86	89
137	55·9	3·4	6·2	35	100	100

3. The effect of different types of phosphatic fertilisers.

Because war exigencies reduced the import of phosphatic rock into Australia, numerous alternative sources of phosphatic fertilisers were investigated and a number of these were tested for their efficiency in promoting crop growth. Experiments with wheat were conducted at two research stations and the grain included in this strength survey.

The rate of application of each fertiliser was 12.3 lb. of total phosphoric acid (P_2O_5) per acre except in the mixture of superphosphate and ground Dandarragan rock phosphate. The sub-acid phosphate was made by treating the rock phosphate with a fraction, usually half, of the normal amount of sulphuric acid with the object of economising in the amount of sulphuric acid. One treatment used the residue from sub-acid superphosphate after leaching out the soluble fraction with water.

The results shown in Table 3 indicate that the type of phosphatic fertiliser used did not materially affect the strength of the flour.

4. Change of seed experiment.

The belief by some farmers that it is an advantage to use seed from another district was tested by growing two varieties of wheat at the Merredin Research Station from seed from three research stations. The results reported by Millington and Langfield (1945) do not indicate any material benefit in yield and the results of the strength tests, Table 4, show no significant difference in the strength of the wheat from seed from different sources.

TABLE 3.

EFFECT OF DIFFERENT TYPES OF PHOSPHATIC FERTILISER ON THE STRENGTH OF WHEAT.

Fertiliser Treatment.	Salmon Gums Research Station—Variety: Bungulla.						Wongan Hills Research Station—Variety: Bencubbin.					
	Farinograph.		Dry gluten	P.T.	Yield		Farinograph.		Dry gluten	P.T.	Yield	
	W.A.	S.F.			Per acre.	Per Cent.	W.A.	S.F.			Per acre.	Per Cent.
	%		%	(mins.)	bus.	%	%		%	(mins.)	bus.	%
(1) Relative strength using superphosphate from various rocks and mixtures.												
A. No fertiliser	56·2	3·8	8·2	35	13·6	91	55·7	3·8	7·1	35	19·0	78
B. From imported rock	56·1	3·5	8·0	36	14·9	100	55·4	3·2	6·6	33	24·5	100
G. From Dandarragan rock	56·7	3·7	8·0	36	15·3	102	55·3	3·3	6·7	33	19·6	80
H. From Dandarragan rock 50%, imported rock 50%	56·3	4·3	9·0	34	16·6	112	55·2	3·0	6·4	34	23·4	96
J. From Dandarragan rock 10%, imported rock 90%	55·8	3·6	8·2	33	15·6	105	55·1	3·3	6·5	36	23·0	94
L. From imported rock 12·3 lb. per acre plus untreated ground Dandarragan rock phosphate 12·3 lb. per acre	56·5	4·0	8·4	34	16·5	111	55·1	3·3	6·4	38	24·5	100
D. From imported rock 6·15 lb. per acre plus untreated ground imported rock phosphate 6·15 lb. per acre	56·1	3·8	8·0	35	16·6	112	55·5	3·2	6·3	33	22·4	91
M. From imported rock mixed with 20 % glauconite	56·7	4·3	8·6	35	15·7	106	54·9	3·3	6·4	36	22·1	90
(2) Relative strength using various ground rock phosphates.												
E. Imported rock	55·5	3·6	7·9	34	13·2	89	56·1	3·5	7·0	35	17·9	73
K. Dandarragan rock	55·9	3·7	8·2	35	14·6	98	55·2	4·0	6·7	36	19·2	78
(3) Relative strength using sub-acid superphosphate.												
C. Sub-acid superphosphate	56·2	3·3	7·8	34	16·0	107	55·6	3·1	6·7	34	20·4	83
F. Residue from sub-acid superphosphate after leaching out water soluble fraction	56·4	3·4	8·0	33	14·4	97	55·5	3·7	6·8	36	18·8	77

TABLE 4.

EFFECT OF CHANGE OF SEED ON STRENGTH.

Merredin Research Station.

Variety. Source.	Farinograph.		Dry gluten.	P.T.	Yield per acre.	
	W.A.	S.F.				
	%		%	(mins.)	bus.	lb.
Bencubbin—						
Avondale	64·5	8·3	12·8	56	13	2
Merredin	60·6	7·2	11·9	50	13	25
Wongan Hills ...	60·5	7·3	12·0	52	11	41
Bungulla—						
Chapman	58·6	6·3	10·8	48	14	2
Merredin	59·3	5·8	11·2	52	15	58
Salmon Gums ...	59·2	5·8	11·1	48	15	30

5. Effect of minor elements.

A small experiment was conducted at the Merredin Research Station to test the effect of minor elements, primarily for the effect of molybdenum, and the results shown in Table 5 indicate that while the use of molybdenum did not affect the strength of wheat the use of a mixture of minor elements effected a marked increase in all strength factors measured.

These results are for one experiment in one season only and must be accepted with reserve, but indicate a field for further work with the object of improving the strength of Western Australian wheat.

Table 5.

EFFECT OF MINOR ELEMENTS ON STRENGTH.

Merredin Research Station—Variety: Bencubbin.

Treatment.	Farinograph.		Dry Gluten.	P.T.	Yield per acre.
	W.A.	S.F.			
	%		%	(mins.)	bus.
No minors	57·0	4·2	8·6	35	38·4
4 oz. molybdenum per acre	59·0	3·8	9·3	36	23·8
16 oz. molybdenum per acre	57·0	3·8	9·3	36	25·4
Mixed minors	61·3	7·2	12·3	57	33·8

The increased strength of the wheat grown with minor elements appears to be due to the increase in protein content. The specific protein quality, measured either in minutes of Pelshenke time per unit of protein (dry gluten) or in strength figure per unit of protein does not differ materially between the four samples when account is taken of the relative inaccuracy of the gluten test. This would indicate that the effect of minor elements is in the growth of the plant not in any modification of the protein (or gluten) formed.

6. Effect of crop rotation.

With the object of working out the most advantageous rotation of crops a "rotation experiment" has been in progress at the research stations for a number of years. The crop rotations used at the three research stations include (a) continuous wheat, (b) wheat, fallow, wheat, (c) stubble or natural pasture, fallow, wheat and (d) two consecutive years of renovating crop, fallow, wheat. At the Chapman and Wongan Hills Research Stations the renovating crop is lupins. No renovating crop is sown at the Merredin Research Station but the "natural" pasture includes several legumes.

From the results in Table 6 the use of a rotation of crops yields stronger wheat than does continuous wheat cropping but the effective rotation is different at different stations.

At the Chapman Research Station the introduction of a fallow year or of a "stubble" year followed by fallow has not materially affected any of the strength factors measured but the use of two years of lupins has markedly increased the strength of the wheat, the increase being of the order of 50 per cent. in strength figure, gluten and Pelshenke time.

TABLE 6.

THE INFLUENCE OF CROP ROTATION ON THE STRENGTH OF WHEAT.

Rotation.	Farinograph.		Dry Gluten.	P.T.	Yield per acre.	
	W.A.	S.F.			1944.	Average (9 yrs.).
Chapman Research Station—Variety: Nabawa.						
	%		%	(mins.)	bus.	bus.
Continuous wheat ...	54·8	3·8	7·4	32	5·3	8·0
Wheat, fallow, wheat	54·8	3·6	7·2	32	6·7	9·7
Stubble, fallow, wheat	54·5	4·0	7·0	32	7·7	11·4
Two years lupins, fallow, wheat	58·0	6·4	10·1	41	11·6	18·8
Merredin Research Station—Variety: Bencubbin.						
	%		%	(mins.)	bus.	bus.
Continuous wheat ...	56·8	5·3	9·0	55	5·6	10·7
Wheat, fallow, wheat	60·1	6·8	11·5	58	15·9	16·9
Natural pasture, fallow, wheat	64·7	10·3	14·8	70	18·4	16·9
Two years renovating crop, fallow, wheat	64·2	9·0	14·4	66	18·1	16·8
Wongan Hills Research Station—Variety: Merredin.						
	%		%	(mins.)	bus.	bus.
Continuous wheat ...	52·2	2·0	5·4	34	5·1	8·1
Wheat, fallow, wheat	53·8	4·6	6·2	42	16·2	14·7
Natural pasture, fallow, wheat	55·7	5·3	7·0	45	22·1	18·3
Two years lupins, fallow, wheat	56·2	5·6	8·2	49	12·7(*a*)	19·6

(*a*) Crop affected by "take-all."

At the Merredin Research Station the increase in strength due to the use of fallow alone is of doubtful validity but the introduction of a natural pasture year before the fallow has markedly increased the strength of the wheat.

At the Wongan Hills Research Station the introduction of a fallow year into continuous wheat cropping has effected an increase in the strength but the further increases in strength through the use of either a natural pasture year or of two years of lupins preceding the fallow year is of doubtful significance.

As in the case of the minor element experiment the improvement in strength in each case appears to be due to the increase in protein (gluten) content and not to any modification of the gluten quality as the specific protein quality as determined either from the strength figure or from the Pelshenke time is sensibly constant at each research station.

Since these results are of one season only, the detailed conclusions as to which rotation increases the strength of wheat must be accepted with reserve but it is considered justifiable to draw the general inference that the strength of wheat can be increased by altering the crop rotation and this offers a fruitful field for investigation in connection with the improvement of the strength of Western Australian wheat.

ACKNOWLEDGEMENT.

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Personalities in Plant Breeding.

THE centenary of William Farrer's birth and the retirement of Mr. J. T. Pridham from the New South Wales Department of Agriculture, are events which serve to remind plant breeders and farmers of their indebtedness to these pioneers. It was Farrer who developed the modern methods of plant breeding. Whilst he worked principally with wheat Pridham applied the same principles to both that crop and oats.

William Farrer was born in England on 3rd April, 1845, and graduated from Cambridge University in 1868. His major field of study was mathematics, but he had intended to adopt medicine as career. However, ill-health prevented him from undertaking further study and he migrated to New South Wales where he earned his livelihood as a surveyor.

Farrer Objectives.

The late maturity of the wheat varieties available to Australian farmers resulted in their cultivation being confined to the wetter regions. The climate and their late maturity made conditions ideal for heavy stem rust infection. In almost every season yields were reduced to negligible proportions by severe epidemics.

Early in 1882 Farrer engaged in a controversy with "The Australasian" on "the possibility and best manner of securing varieties of wheat which would satisfactorily resist rust." During this controversy Farrer formulated the principle that "whenever well directed attention is given to the improvement of a domesticated plan in any quality in which it is variable, that quality can be increased and developed to an indefinite extent." The chief source of his inspiration was the success of the French and German plant breeders in doubling the sugar content of the beet. The technique of drawing on world wide sources for different characteristics and blending them into one variety, was developed by Farrer and is the basis of modern plant breeding.

Farrer Wheats.

Although he never achieved his objective of a rust resistant variety, his early maturing wheats such as Bunyip and Sunset could be cultivated in the drier inland districts, where rust was seldom a problem. These early maturing varieties also made it possible to extend the wheat belt into the drier interior of Australia where vast areas of suitable land were available. These today form the wheat belt of Australia.

The Improvement of Flour Strength.

Farrer directed considerable attention to the improvement in flour strength of cultivated varieties since it was at that time necessary to import strong flour Canadian grain for blending with the Australian f.a.q. By developing varieties such as Comeback from crosses between the Canadian Fife and Indian wheats, he removed the necessity for these importations. The superiority of Federation, the most successful of the Farrer productions, over its contemporaries is evident from its record as the most extensively cultivated variety in Australia from 1910 to 1925. It is still an important variety in the Pacific Coast States of America.

Farrer as a Scientific Worker.

Many of the difficulties encountered by Farrer in breeding rust resistant varieties could not be overcome until advances had been made in associated sciences such as Plant Pathology. It was Farrer, for instance, who early appreciated the need in breeding work to differentiate between stem rust and leaf rust.

Working without the modern aid of formulated breeding laws, Farrer brought a logical mind to the vast field of plant breeding. His success was a direct inspiration to plant breeders in Australia and the world over. Experimental breeding stations were established to follow his methods of plant improvement.

Farrer's Influence on Plant Breeding in Western Australia.

Western Australia was fortunate to have the services of Dr. G. L. Sutton when consideration was being given to the revival of cereal breeding work in this State some 30 years ago. Dr. Sutton was associated with and succeeded Mr. Farrer at the Cowra Experiment Farm prior to coming to this State. When he organised the plant breeding work in Western Australia, he was aided by the experience so gained. The developing of Nabawa, Bencubbin and other successful West Australian varieties is convincing evidence of the excellent organisation which he built up in Western Australia. The modified and improved Farrer methods developed by Dr. Sutton for local conditions are still largely practised by plant breeders and most modifications have been in the nature of refinement in technique rather than a change in fundamental principles.

Plant Breeding in New South Wales.

Another early associate of William Farrer was Mr. J. T. Pridham who conducted the plant breeding work at Cowra from 1911 to 1944. He applied the Farrer methods to oats as well as wheat and was probably the first man in Australia to artificially cross varieties of the former. His principal oat varieties, Guyra, Lachlan, Sunrise and Mulga are still major varieties in the Western Australian Wheat Belt. Oat improvement is notoriously difficult and only in recent years has it been possible to develop any West Australian varieties such as Dale, Ballidu and Wongan which promise to at least partly replace the Pridham varieties.

Dundee is perhaps the best known of the wheats bred by Mr. Pridham. On 26th April, 1945, Mr. Pridham retired from the New South Wales Department of Agriculture and he will have in his retirement the best wishes and good will of farmers and plant breeders which he so richly deserves.

The vision and enthusiasm of these pioneer plant breeders is an inspiration to those upon whom the further improvement of cereal varieties has devolved. The farming community is indebted to them collectively for now having at their disposal, cereal varieties well suited to a wide range of soil and climatic conditions.

Cobaltised Superphosphate.

L. J. H. Teakle, Plant Nutrition Officer.

In 1937 spectacular success was obtained in New Zealand from the use of a fertiliser consisting of a mixture of cobalt chloride and superphosphate. It was used on country on which stock became affected with "bush sickness," a disease which had been found to be due to cobalt deficiency. Subsequent experiments confirmed this result and led to the commercial production of cobaltised superphosphate in New Zealand. The early results from the application of cobaltised superphosphate have been reported by Askew, Rigg and Stanton (1938) and Askew (1939). This fertiliser is now in common use in many districts in New Zealand to correct cobalt deficiency of stock.

The experiments carried out in New Zealand demonstrated that very small quantities of cobalt per acre would maintain stock healthy on deficient country for at least one year, and annual dressings were advocated. In 1939, two grades of cobaltised superphosphate were on the market, one containing 6 lbs. and the other 12 lbs. of cobalt sulphate per ton. It was recommended that these fertilisers be used in quantities designed to supply 5 and 10 ozs. respectively, of cobalt sulphate per acre.

When the shortage of superphosphate became acute during the war years, experiments were conducted by Maunsell and Simpson (1944) using other carriers for the cobalt sulphate, and it was found that it was equally effective whether mixed with superphosphate, serpentine superphosphate, lime and superphosphate, lime alone, beach sand or pumice or dissolved in water. In 1942 the New Zealand Department of Agriculture recommended that at least 5 ozs. of cobalt sulphate per acre in a suitable mixture be applied annually to cobalt deficient land. Drenches or licks were to be used if cobalt fertilisers were not obtainable.

Later work by Askew (1944) at Sherry River, Nelson, in the South Island of New Zealand, showed that good results were obtained with even smaller dressings of cobalt sulphate, as little as 2 ozs. per acre annually being effective. This experiment with sheep, conducted over a period of two years, indicated that 2 ozs. annually (applied September, 1941, and September, 1942) if anything, was slightly superior to 4 ozs. applied in September, 1941, and none subsequently. However, in this experiment, a better growth still during this period was observed on the pastures which had received 1 lb. of cobalt sulphate per acre in August, 1940, and only superphosphate subsequently. The control sheep, grazed on pastures which had received only superphosphate, barely maintained life. These results indicate that the more generous dressings of cobalt are desirable, but to save heavy initial expense, several small dressings annually may be used with good results.

It is of interest that the discovery of cobalt deficiency as the cause of a stock ailment was made in Western Australia. Underwood (1935) and his associates found that the Denmark Wasting Disease, or *enzootic marasmus* as it is called, was due to shortage of cobalt in certain soils and could be prevented and cured by feeding licks containing cobalt. The New Zealand workers utilised this discovery in devising methods for the control of similar disorders of stock in their country.

In Western Australia the feeding of stock licks containing cobalt is generally used to control the wasting disease. Most popular, is the so-called Denmark lick, in which limonite is the carrier of the cobalt. Although recommended as a fertiliser shortly after the discovery of the cause of Denmark Wasting Disease, cobaltised

superphosphate, so popular in New Zealand, has not yet been used commercially in Western Australia. However, the results of New Zealand experience have aroused the interest of farmers, and as a result of a request from the Denmark Branch of the Primary Producers' Association of W.A. (Inc.), a parcel of cobaltised superphosphate is being manufactured for use in Western Australia. Cobalt sulphate has been obtained from South Australia and the manufacturers have been recommended to prepare a mixture containing 5 lbs. per ton of superphosphate. This mixture applied at 140-150 lbs. per acre will supply about 5 ozs. of cobalt sulphate per acre. Annual dressings for at least three years are recommended to build up the application to about 1 lb. of cobalt sulphate per acre. The New Zealand experience indicates that this cobalt status should then be satisfactory for several years, with the use of ordinary superphosphate.

Cobalt sulphate is an expensive salt and it is estimated that the cost of the cobaltised superphosphate will be approximately £2 per ton more than ordinary superphosphate. The extra cost of fertiliser per acre will be approximately 2s. 6d.

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The Soils of the East Pingrup-Lake Magenta Area.

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SUMMARY AND CONCLUSIONS.

1. In the period 2nd to 13th July, 1945, a soil reconnaissance in the East Pingrup-Lake Magenta area was made in company with Mr. J. St. C. Brockway, Surveyor of the Lands and Surveys Department.

2. The abnormal rains in June—697 points were recorded at Pingrup—made the tracks in the area very difficult, and it was not possible to make such extensive investigations as would have been possible in a drier season. However, Mr. Brockway's knowledge from previous work in the area, together with classification plans prepared in 1926 by Surveyor C. L. Findlay, form an accurate supplement to the present studies.

3. From this reconnaissance of the East Pingrup-Lake Magenta area the conclusion is reached that, except for the occurrence of some large tracts of laterite scrub plain, its soils resemble those of the portions of the Salmon Gums district around Grass Patch and Scaddan. Since the climate is also similar, its development for agriculture would involve similar problems.

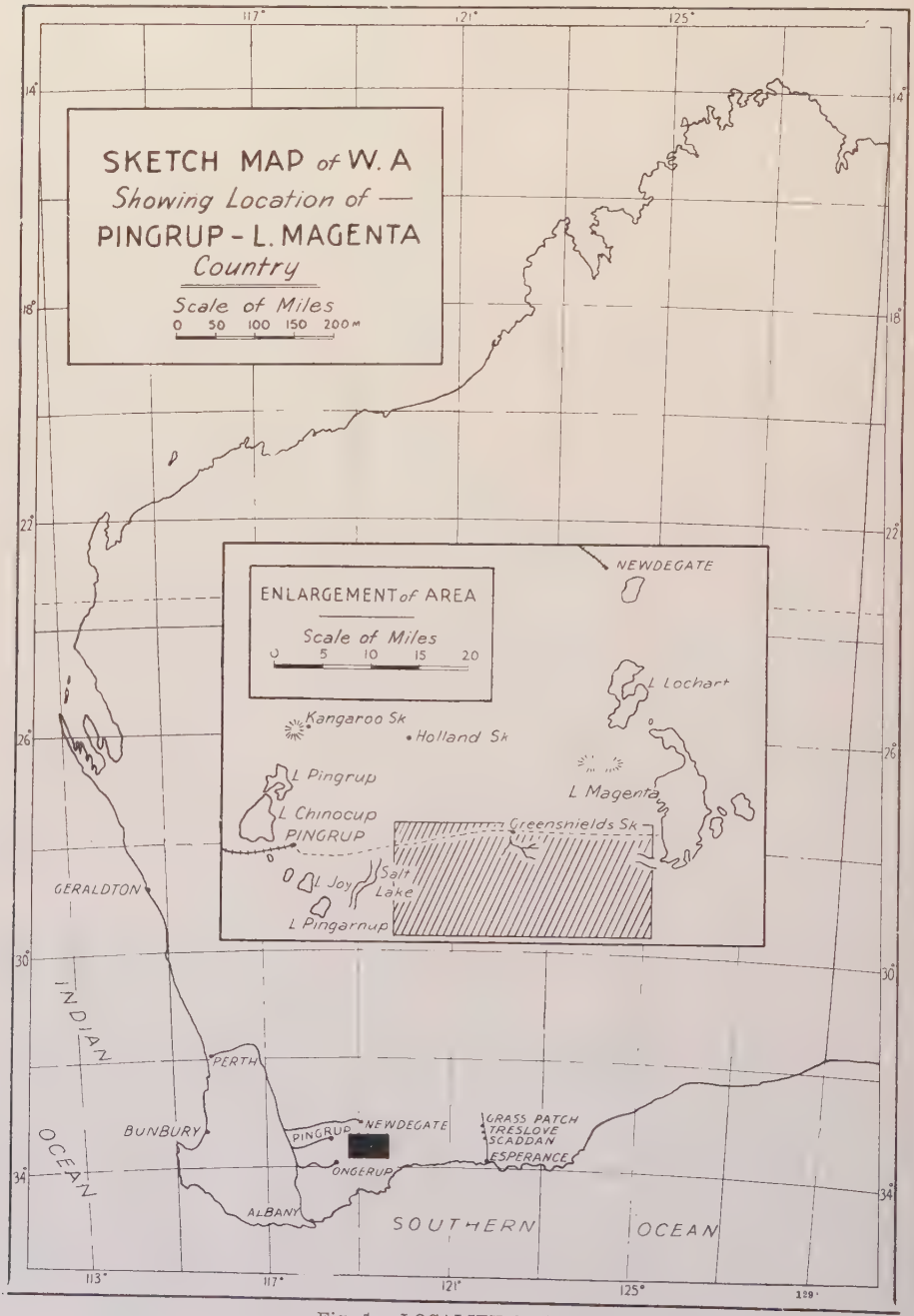


Fig. 1.—LOCALITY PLAN.

4. Six main groups of soils were recognised:—
   A.—Sandy surfaced soils with a domed, sandy clay subsoil;
   B.—Grey, heavy soils;
   C.—Brown and red-brown heavy soils;
   D.—Brown, medium-textured soils;
   E.—Sandy, gravelly soils on laterite subsoil;
   F.—Sandy, gravelly soils on alkaline clay subsoils.
5. The salt content of the soils of groups B, C, and D, is unduly high.
6. None of these soils is regarded as first-class for cereal growing. Groups B and C are generally unsuitable. Groups A, B, C, and D, would be satisfactory for Wimmera rye grass.
7. Any land classification in this area to assess its suitability for agriculture should be based on a careful survey of the soils, with particular attention to salt status and related soil properties.

LOCATION OF AREA INVESTIGATED.

Lake Magenta lies about 37 miles east of Pingrup and is accessible by a track going east from Pingrup to Ravensthorpe (see Fig. 1.). The area under review extends about eight miles north and eight miles south of this track, but more particularly attention was devoted to the area east of Kent Location 795, which is about 17 miles from Pingrup on the Ravensthorpe track. Hence an area about 20 miles by 16 miles was involved. This is mostly an area of virgin country, though a small amount of sub-division and clearing was done in the 1920-1930 period chiefly associated with pockets of salmon gum forest. These properties have long been abandoned.

GENERAL FEATURES OF THE AREA.

Between the salt lake systems at Pingrup and Lake Magenta is a belt of undulating country covered mainly with mallee vegetation associations. In the higher parts are some more or less extensive scrub plains with scattered blue mallee, or tallerack (*Euc. tetragona*). The soils on these plains are sandy and gravelly with fairly massive laterite at shallow depths, and represent the remnants of the laterites which, in an earlier and much wetter climatic cycle, were probably much more extensive. Pockets of salmon gum forest occur mainly in broad valleys and local depressions. Moort (*Euc. platypus*) is an element of the vegetation in parts, especially on grey heavy soils.

The general drainage pattern of the area is not well defined, for, under the present annual rainfall of about 15 inches with a low average per wet day, there is seldom any considerable runoff. The heavy rains of June, 1945, have caused water movements along and into some of the broad valleys and local depressions.

Rock outcrops are not common, but those noted, together with evidence from dams and soil borings, suggest that rocks of a granitic type probably underlie the area in general. In several soil borings in moort country the decomposed rock had a very talcy feel.

SIMILARITY TO PARTS OF THE SALMON GUMS DISTRICT.

The bulk of the area has strong general resemblances to the Grass Patch-Scaddan portions of the Salmon Gums district. The soils, vegetation and climate are generally similar, and, this area east of Pingrup must be considered as the western edge of the southern part of the Fitzgerald region as mapped by Teakle in his "Regional Classification of the Soils of Western Australia (1938)."* Further, if any consideration is given to the settlement and development of this area, experiences in the Grass Patch-Scaddan area should be taken as a guide.

* Journal of the Royal Society of W.A., Vol. 24, 1937-38, pp. 123-195.

Because the occurrence of salt, and associated soil features, have been shown to be major factors in the problems of the Salmon Gums district, special attention has been given to the salt content of the East Pingrup-Lake Magenta soils. It has been found that they are generally similar in this respect to the Salmon Gums soils.

RAINFALL.

Lake Magenta lies within a triangle formed by lines joining Pingrup, Ravensthorpe and Newdegate. The rainfall figures for these centres, supplied recently by the Commonwealth Weather Bureau are set out in the following table. Figures for Grass Patch and Scaddan are included for comparison.

RAINFALL IN VARIOUS CENTRES.

Centre.	No. of Years Records.	Rainfall (points)—100 points = 1 inch.												Annual.
		Jan.	Feb.	Mar.	Apl.	May.	Jun.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
Pingrup	17	72	26	152	80	191	193	224	192	139	131	70	50	1,520
Ravensthorpe	41	74	65	145	132	176	155	179	177	143	157	99	97	1,599
Newdegate	17	69	26	147	90	165	179	208	179	109	131	61	51	1,414
Grass Patch	14	103	50	117	103	144	176	154	183	108	143	120	64	1,465
Scaddan	20 (to 1937)	48	49	122	149	223	224	165	203	149	135	97	82	1,646
Pingrup, 1945	....	....	1	116	50	143	697	211	309	116	5	26	...	.

It is apparent from the table that the average annual rainfall of the East Pingrup-Lake Magenta area is about 15 inches. General experience has shown that this rainfall is sufficient for mixed cereal and stock farming where the soil conditions are satisfactory, and especially where the rainfall in the spring months of September and October averages more than an inch.

SOILS.

The soils of the East Pingrup-Lake Magenta area show a general similarity to the soils of Grass Patch and Scaddan districts. In particular, there are large areas of soil with a sand surface overlying a sandy clay subsoil. The upper part of this subsoil clay forms roughly rounded domes, mostly six to 12 inches across, As a result, the sandy surface is frequently only one or two inches thick on the tops of the domes but may be nine inches or more deep between them. An almost identical soil occurring around Scaddan, and north towards Grass Patch, has been named the *Scaddan sand* and has been described in detail by Burvill and Teakle.* Such soils are known as *solonetz soils,* and occur in various parts of the world. Because of their physical and chemical properties they are not highly regarded for agriculture, although in the Salmon Gums-Scaddan areas sandy surfaced types with sandy clay subsoils have proved more satisfactory for cereals than other groups of soils.

Heavy soils with clay-loam and clay surfaces and tough clay subsoils occur to a lesser extent than the sandy surfaced types. They are mostly associated with moort and a form of gimlet† (*Euc. annulata*), and are generally grey, but some-

* *Jour. Agric.,' West Aust.,* Vol. 15, 1938, pp. 97-109.

† Four trees in Western Australia are popularly called "gimlet." The one of most general distribution, and which is commonly associated with good soils in the main wheatbelt, is *Euc. salubris.* The one recognised on this reconnaissance, *Euc. annulata,* is less common and generally restricted to the south-eastern part of the wheatbelt. A third type, *Euc. diptera,* occurs only in the vicinity of Salmon Gums. The fourth, silver topped gimlet (*Euc. campaspe*), grows in the Coolgardie goldfield region.

times brown. These soils are generally high in salt and from experience with related types at Salmon Gums would be troublesome if developed for agriculture, because of the excess salt.

The sandy gravelly soils of the high level scrub plains have dense gravel or massive laterite in the subsoil, but other sandy gravelly areas with mallee have sandy clay subsoils, with lime nodules, below 12 to 18 inches of gravelly sand. Such soils would not be subject to salinity troubles and might prove useful soils for general farming.

SALT STATUS AND RELATED SOIL PROPERTIES.

One hundred and thirty-three soil samples were collected from 40 representative sites for analytical work. Salt and reaction (pH) have been determined and the details are set out in the attached Table 1. For convenience of description and for consideration of the salt data, the soils have been divided into seven groups, for which details are as follow:—

Group A.—Sandy-surfaced Soils with a Domed Sandy Clay Subsoil.

This seems to be the most extensive group of soils in the area. The soil profile has a few inches of sand resting abruptly on a well-domed sandy clay subsoil. The surface sand is grey-brown in the upper part, but is light grey and bleached below and in the crevices between the clay domes. The depth of sand above the tops of the domes ranges from one to six inches, but is usually less than three inches. The sandy clay subsoil is of greyish yellow colour with limestone nodules below 12 inches. In many cases no lime was found below 36 inches and well-weathered rock apparently of a granitic type, occurs in the sandy clay.

Group A soils carry a mallee vegetation association usually. *Eucalyptus spathulata, E. oleosa, E. Flocktoniae, E. eremophila* are common, also broombrush (*Melaleuca uncinata*) and other teatrees, needlebush (*Daviesia* sp.) and a "cactus" Acacia (*A. glaucoptera*). Salmon gum (*Euc. salmonophloia*), manna gum (*Acacia* sp.) and hop bushes (*Dodonea* sp.) occur on some areas.

Data for salt and pH are given in Table 1A. The salt figures are somewhat variable, but not generally very high. At two sites only was more than 0.30 per cent. sodium chloride found in the second foot. This may possibly be due to the exceptionally heavy June rains this year. Experience in the Salmon Gums district has shown conclusively that such sandy surfaced soils undergo a leaching of salt from the upper parts of their subsoil clay after clearing, apparently because greater amounts of water move through the soil. In this case, although the areas are still under mallee vegetation, a similar effect might be produced by the seven inches of rain which fell in June without a great deal of runoff.

The effect of the leaching is that, under agriculture, such sandy surfaced soils are generally free of salt troubles. Where the sandy surface is less than three inches deep, some ploughing up of the sandy clay subsoil occurs, and this results in bare patches of bad tilth where salt concentration may occur. Most of the sandy surfaced solonetz soils in the East Pingrup area seem to have less than three inches of sand above the domes of the clay subsoil.

The high pH values for the subsoil are normal for soils of this type. A considerable drop in pH is recorded for layers below three feet at some sites. This feature is also common in the Salmon Gums district.

Group B.—Grey Heavy Soils, Generally Associated with Moort.

These soils are far less extensive than Group A, and because of salt and heavy surface texture, are unattractive for agriculture. The surface soil is usually grey clay-loam or clay and passes quickly into grey or yellowish grey

tough clay, sometimes containing free lime in a soft form, though not always apparent till tested with acid. Below two feet, some brown mottling occurs, and decomposed rock with a talcy feel was found at a number of sites. White quartz grit and fragments often occur on the soil surface. Crabholes were noted in some parts.

Moort thickets, with varying amounts of gimlet (*E. annulata*) and with very little undergrowth are common on these soils. Some areas were carrying salmon gum and mallees, while two sites—one a bare salt patch—were in an area cleared and cultivated many years ago, but now abandoned.

From Table 1B it will be seen that Group B soils are generally high in salt, even in the first foot. Samples from sites 13 and 15 in the cleared area have very high pH values and were noted to be extremely sticky and difficult to sample. Sites 19 and 34, although resembling the other sites in most respects, are acid in reaction throughout with very acid subsoils—pH values below five. Dr. Teakle, in his "Regional Classification of Western Australian Soils" has recorded that the soils of the moort country in the Stirling and Avon regions around Ongerup are sometimes acidic and sometimes alkaline in the subsoil. The reasons are not apparent.

Group C.—Brown and Red-Brown Heavy Soils Carrying Gimlet (E. annulata) *and Mallees.*

These soils are closely related to the Kumarl clay-loam of the Salmon Gums district, a soil with a particularly bad record for salt troubles. This group of soils seems very restricted at East Pingrup and only two sites were sampled. The soil profile has a shallow surface layer (about one inch) of brown sandy loam or clay loam, passing to brown or reddish brown clay. Soft lime occurs in the brown clay in the second and third foot. Below three feet there is less lime and the clay becomes more gritty with well decomposed rock fragments.

The vegetation is composed of gimlet (*E. annulata*) saplings or whipsticks, mallees including *E. oleosa* and *E. spathulata*, hopbushes (*Dodonea* spp.), teatrees and umbrella bush (*Melaleuca* spp.), needlebush (*Daviesia* sp.) and clay bush (*Acacia* sp.).

Of the two sites sampled, one was high and one medium with respect to salt—see Table 1C.

Group D.—Brown Medium Textured Soils of Some of the Salmon Gum Areas.

These soils are not extensive. They appear similar to the salmon gum forest soils of the eastern wheatbelt, e.g., around Merredin, Lake Brown and Nungarin.

The soil profile has a brown or grey-brown mellow sandy loam surface, passing into brown or grey-brown mellow sandy clay-loam. Much soft lime occurs below 12 inches and gives a much lighter colour to the subsoil. Below three feet the lime is less evenly distributed in the brown sandy clay. One site bored to more than six feet had no lime below 5½ feet. Small fragments of a granitic rock were noted on the surface in places.

The vegetation consists of open salmon gum forest with mallee in places. Scattered undergrowth of centipede bush (*Templetonia sulcata*) and clay bushes occurs, also patches of a prostrate salt bush, probably a *Bassia* and a pigface, probably *Mesembryanthemum*.

Of the three sites sampled (Table 1D), two were high in salt. The third was low but cannot be regarded as typical on account of the shallow rock encountered.

Group E.—Sandy Gravelly Soils of the Scrub Plains and Mallet Areas.

These soils are formed on the residuals of the old laterite and form scrub plains which are extensive in some parts, as shown by Surveyor C. L. Findlay's 1926 classification. Little attention was devoted to them in the present investigation as previous experience has shown that salt is rarely a factor in these soils. The soil profile has a variable depth of greyish yellow gravelly sand over more or less massive laterite. The laterite is apparently less than a foot in many places, and is often exposed in tracks. Low scrub with scattered blue mallee or tallerack (*E. tetragona*) is the usual vegetation. *E. angulosa* mallee also occurs in places where the gravelly sand is deeper.

On some related sandy gravelly types, mallet (*E. falcata*) and *E. angulosa* occur in this area.

Table 1E gives analytical data for three sites in these various very gravelly soils. Although these soils are inherently of very low fertility, they cannot be dismissed as useless, judging from results in the farming of scrub plain country in various parts of the wheatbelt.

Group F.—Soils with Deep Sandy Gravelly Surface Soil but with Alkaline Clay Subsoils.

The surface of this group is related to Group E, but the subsoil is generally similar to Group A, i.e., a greyish-yellow or mottled sandy clay with limestone nodules. The gravelly sand surface is usually more than a foot deep.

The vegetation is generally various mallees with broombush, teatrees and minor scrubs.

Table 1F gives analytical data for five sites in this soil group. The subsoil clays are alkaline and show salt accumulation, but with such deep sandy surfaces no salt troubles would occur if they were developed for agriculture. They might prove even more suitable on the whole, for cereals, than the soils of Groups A, B, C and D. However, they do not seem to be very extensive.

Miscellaneous Soils.

Samples from three sites, representing minor miscellaneous soil conditions, were collected. Details are given in Table 1G.

THE RELATION OF NATURAL VEGETATION TO SOIL TYPE AND LAND CLASS.

During the reconnaissance, general note was taken of the relation of vegetation to soils and some observations seem worth recording.

Small areas of salmon gum forest occur scattered through the East Pingrup area, especially in some of the broad valleys. In earlier land classifications, e.g., Survey C. L. Findlay's 1926 classification, these areas were mapped as first-class land in keeping with the general practice in wheatbelt classifications. Mallee areas were generally regarded as second-class, and scrub plain third-class. In the present investigation it was observed that the patches of salmon gum country were not constantly associated with soils of any one group. While the brown, medium-textured soils (Group D) were always associated with salmon gum timber, salmon gums also grew on soils similar to Group B, which commonly carry mallee or moort vegetation associations, and to Group A, which are solonetz soils with grey sandy surfaces over greyish-yellow domed, tough sandy clay subsoils.

The conclusion was reached that salmon gum was in this area quite unreliable as a soil indicator. Further it seems likely that vegetation succession may have occurred and may account for different vegetation on similar soils. A large part of the area must have been swept by severe fires five or six years ago. Some salmon gum areas had the trees killed to the tops, and in such cases vigorous mallee growth now occurs among the dead salmon gums. There is also salmon gum regrowth, but it may not ultimately survive in competition with the mallee species.

This area also exemplifies the conclusion reached in other mallee areas, e.g., Salmon Gums, that the size of mallee growth is not an indicator of soil type or quality. The occurrence of bush fires at varying intervals results in mallee vegetation of varying sizes on the same soil type. Sometimes no remnants of the previous growth remain, either living or dead. In such cases, any land classification for potential agricultural use should be based on a careful examination of the soils. This becomes even more necessary in our light rainfall areas where high salt concentrations occur in many soils, but cannot be detected by the natural vegetation.

Table 1.

RESULTS OF SOIL INVESTIGATIONS, EAST PINGRUP-LAKE MAGENTA, JULY, 1945.

Data for Salt and Reaction (pH).

Salt figures are calculated from chloride and expressed as sodium chloride per cent. of air dry soil. Reaction was determined on the 1 : 5 extract by the quinhydrone electrode.

Site No.	First Foot.			Second Ft.		Third Ft.		Deep Subsoil.					
Book 232	Depth.	Salt.	pH.	Salt.	pH.	Salt.	pH.	Depth.	Salt.	pH.	Depth.	Salt.	pH.

Table 1A.

Group A.—Soils with grey-brown or grey sand surface one to six inches deep, overlying a yellow-grey domed tough sandy clay subsoil. Mallee vegetation usually. Site 4 is in Salmon Gum country.

	ins.	%		%		%		ins.	%		ins.	%	
1	3–12	·02	7·8	·06	8·6	·21	8·7	36–42	·22	8·3	....	..	
3	2–12	·11	8·4	·11	8·6	·10	8·6	....	....	....	....	....	..
4	0–3	·01	6·4	....	....	....	....	....	....	....	....	....	..
	3–12	·03	8·1	·12	8·6	·12	8·6	36–54	·07	8·3	54–63	·12	8·2
	....	....	....	....	....	....	....	....	....	....	63–90	·11	7·9
	....	....	....	....	....	....	....	....	....	....	90–110	·13	5·8
5	1–12	·09	8·3	·29	8·7	·33	8·5	....	....	....	....	....	.
6	6–12	·04	8·0	·28	8·6	....	....	....	....	....	....	....	.
16	3–12	·13	8·4	·17	8·7	·29	8·5	36–54	·27	8·4	....	....	.
20	2–12	·15	8·9	·23	9·0	....	....	....	....	....	....	....	.
22	3–12	·06	8·7	·29	8·8	·43	8·4	36–54	·43	6·9	....	....	....
23	2–12	·15	8·3	·26	8·8	·21	8·5	....	....	....	45–66	·37	7·6
24	5–12	·04	8·5	·09	8·7	·27	8·6	36–54	·21	8·6	54–60	·34	7·8
32	1–12	·20	8·6	·45	8·3	·60	7·9	36–54	·63	6·0	....	....	...
36	0–12	·08	8·6	·34	8·7	·56	8·6	36–60	·59	8·5	....	....	....
39	3–12	·04	8·7	·18	8·9	·32	8·6	....	....	....	....	....	..
40	1–12	·03	7·1	·21	8·6	·33	8·7	36–54	·28	8·1	....	....	..

Table 1B.

Group B.—Grey heavy soils generally associated with moort.

	ins.	%		%		%		ins.	%		ins.	%	
13	0–3	·29	9·0	....	....	} Bare patch in old cleared area.							
	3–12	1·35	8·6	....	....								
15	....	·05	9·0	·18	9·2	Grassy area in clearing							
14	0–6	·18	8·7	....	....	....	....	....	....	....	....	....	....
	6–12	·52	8·6	·46	8·6	·39	8·7	36–42	·39	7·6	....	....	....
17	0–1	·02	7·2	....	....	....	....	....	....	....	....	....	....
	1–12	·25	8·4	·48	8·2	·48	8·0	....	....	....	....	....	....
33	....	·80	8·7	1·07	8·5	1·10	7·8	....	....	....	....	....	....
21	....	·33	8·8	·31	8·9	·26	6·8	Salmon Gum					
31	....	·29	8·8	·44	8·8	·49	7·6	36–42	·64	6·4	Salmon gum and moort		
19	....	·17	5·5	·27	4·5	·38	5·0	36–60	·48	4·8	60–72	·39	4·8
34	....	·06	6·6	·14	4·9	·26	4·6	36–45	·41	4·5	....	....	....

TABLE 1—*continued.*

RESULTS OF SOIL INVESTIGATIONS, EAST PINGRUP-LAKE MAGENTA, JULY, 1945—*continued.*

Site No.	First Foot.			Second Ft.		Third Ft.		Deep Subsoil.					
Book 232....	Depth.	Salt.	pH.	Salt.	pH.	Salt.	pH.	Depth.	Salt.	pH.	Depth.	Salt.	pH.
	ins.	%		%		%		ins.	%		ins.	%	
12	½–12	·16	8·8	·28	8·8	·29	8·8	....	....	....	....	....	..
28	....	·25	8·7	·42	8·7	·38	8·8	36–54	·42	7·7	....	....	..

TABLE 1C.

Group C.—Brown and red-brown heavy soils with gimlet (*E. annulata*) and mallees.

	ins.	%		%		%		ins.	%		ins.	%	
12	½–12	·16	8·8	·28	8·8	·29	8·8	....	....	....	....	....	..
28	....	·25	8·7	·42	8·7	·38	8·8	36–54	·42	7·7	....	....	..

TABLE 1D.

Group D.—Brown medium textured soils of some of the salmon gum areas.

	ins.	%		%		%		ins.	%		ins.	%	
11	0–3	·02	7·7	....	....	....	....	....	....	....	....	....	....
	3–12	·39	8·9	·46	8·8	·42	8·9	36–42	·43	8·9	....	....	....
30	....	·29	8·8	·40	9·0	·34	9·0	36–66	·28	9·0	66–75	·43	8·0
29	....	·02	7·6	·02	7·6	Stone at 20 in.							

TABLE 1E.

Group E.—Sandy gravelly soils of the scrub plains and mallet areas formed from laterite residuals.

	ins.	%		%		%		ins.	%		ins.	%	
26	No analysis—solid laterite 9in.												
35	....	....	....	·10	5·6	Sample 20 in-30 in.; Soft ironstone at 30 in.							
18	....	·02	7·4	·05	7·7	Mallet area, very gravelly, no solid laterite to 30 in.							

TABLE 1F.

Group F.—Gravelly sand surface soil usually 12 in.-24 in. deep, alkaline calcareous sandy clay subsoils. Mallee vegetation.

	ins.	%		%		%		ins.	%		ins.	%	
7	0–6	·01	6·4	....	....	....	....	....	....	....	....	....	....
	6–12	·04	8·6	·23	8·6	·40	8·3	36–60	·43	7·8	....	....	....
8	0–15	gravelly sand		·06*	7·5	·18	8·4	....	....	....	..	....	..
10	0–18	,,		·06*	8·8	·19	8·5	....	....	....	..	....	....
25	0–15	,,		·10*	8·7	·22	8·6	36–54	·32	8·6	..	....	....
37	0–12	,,		·06	8·6	·22	8·5	....	....	....	..	....	..

* 15-24, 18-24, etc.

TABLE 1G.

Miscellaneous Soils.

	ins.	%		%		%		ins.	%		ins.	%
2	....	·01	7·3	·09	8·6	·23	8·3	Associated	with	very	micaceous	rock.
9	0-12	Sand	....	·04	7·6	·17	6·6	36–48	·16	5·9	Broad depression near Greenshields Soak.	
38	0-10	·01	6·0	·03	6·0	Gritty soil on weathered granite at 21 in.						

Infectious Pneumonia of Pigs.

C. R. TOOP, Senior Veterinary Surgeon.

INFECTIOUS pneumonia is a common disease of pigs in Western Australia. It has a wide distribution and evidence of its existence in one form or another may be found in a large proportion of piggeries throughout the State. The disease is largely confined to young pigs. For the most part it occurs in the chronic form giving rise to symptoms of coughing together with unthriftiness and retarded growth in consequence of which it is a source of considerable loss to the pig industry. In addition the disease may occasionally assume an acute form when it is accompanied by serious mortality. The disease results from the infection of the lungs with bacteria, the organisms responsible invading the lung tissues after the resistance of the animal has been lowered by exposure to unfavourable conditions associated with faulty management and improper feeding.

Proper attention to management and feeding provides the most effective means of controlling the disease.

These pigs are approximately the same age. The pigs on the right became affected by infectious pneumonia prior to weaning. The animals on the left are healthy.

CAUSE.

The disease results from a mixed bacterial infection, a number of different organisms being involved. These organisms may normally be present in the respiratory passages of healthy pigs where they cause no ill effects. Whenever, however, the animal is exposed to unfavourable conditions which lower its vitality and reduce its resistance to infection the organisms are able to invade the lung tissues setting up an inflammatory condition known as pneumonia. Among the factors which lower the resistance of young pigs to infection thus predisposing them to the disease may be included exposure to wet insanitary conditions, the use of cold, damp draughty sties or shelters and faulty nutrition resulting from the feeding of a ration inadequate in quantity or lacking in essential nutrients.

Under such circumstances outbreaks of the disease may and frequently do occur without any history of infection having been introduced on to the property by the purchase of affected pigs from an outside source. When the disease has become established on a property it is definitely infectious. Affected pigs pass out large numbers of infective organisms in their excretions, thus spreading the disease to other animals with which they come into contact. An outbreak of pneumonia may consequently occur on a piggery following upon the introduction of infected pigs into the herd, and every care should be exercised when new purchases are being made.

SYMPTOMS.

Infectious pneumonia is almost essentially a disease of young pigs, which may become affected from within a week or two of birth until they reach the age of three to four months. Weaners are especially susceptible. Older pigs are much more resistant to infection and the disease is rarely a serious problem in pigs after having reached the porker stage.

The disease usually occurs in the chronic form, but acute outbreaks accompanied by considerable mortality are sometimes encountered. Animals affected by the acute form of the disease become dull and listless, are disinclined to feed and lose condition rapidly. The temperature is high and a red rash may appear

on the under surface of the body. The respiration becomes rapid and laboured, and this is accompanied by the development of a dry spasmodic cough. A muco-purulent discharge from the eyes and nose which upon drying may gum the lids together is frequently observed. The affected animals lie down almost continuously. When forced to rise they stand with the back arched and walk with an unsteady staggering gait. Death frequently occurs within a week to ten days from the onset of symptoms.

The outstanding symptoms in the chronic form of the disease are coughing and unthriftiness. The chronic disease is sometimes a sequel to the acute form, but more often the condition is chronic from its onset. The affected animals develop a sharp dry spasmodic cough which is particularly noticeable after exertion and may be provoked by driving them a short distance. The respiration is laboured and sometimes jerky. Such animals are poor in condition, stunted and unthrifty in appearance, and their growth and development is seriously retarded.

Frequently the disease occurs in a much milder form the only observable symptom being the presence of a spasmodic cough which is not accompanied by any loss of appetite or condition. Even in these slightly affected animals, however, growth is somewhat retarded and a longer period of time is required to bring them to marketable weight. Affected animals usually recover upon reaching the porker stage and thereafter make satisfactory progress. In some cases, however, the cough may persist until they are removed from the property as baconers.

Recovered animals although apparently healthy in appearance may continue to harbour infection, and this is illustrated by the large number of pigs showing pneumonic areas in their lungs when subsequently submitted to post mortem examination at abattoirs and bacon factories. There is reason to believe that breeding sows affected in this manner may remain carriers of infection which they subsequently transmit to their litters.

POST MORTEM APPEARANCES.

At post mortem examination the principal abnormalities are found in the thorax or chest cavity. The affected lungs contain more or less extensive pneumonic areas which are dark red in colour and firm and solid in consistency contrasting sharply with the healthy lung tissue which is spongy and elastic and pale pink in colour. A portion of the affected lung tissue if placed in water will sink to the bottom whereas healthy lung tissue will float. In the more chronic cases the affected portions of the lung are pale or greyish in colour and when incised the cut surface may be observed to be studded with small yellow necrotic (composed of dead tissue) areas. In some cases there is evidence of pleurisy, the lungs being firmly adherent to the chest wall. The carcase is usually thin and emaciated.

PREVENTION AND CONTROL.

The control of the disease largely resolves itself into a question of efficient management. Medicinal treatment of affected animals is not satisfactory nor can beneficial results be expected from the use of vaccines.

Since exposure to unfavourable conditions associated with faulty management and improper feeding predisposes to the disease and is responsible for a large proportion of the outbreaks which occur, these matters should receive careful consideration and faults which are found to exist should be corrected. In this connection it is significant that infectious pneumonia despite its widespread distribution is rarely a serious problem on well conducted piggeries.

In the application of control measures the following matters should receive attention:—

Housing.

Young pigs should be provided with dry warm comfortable quarters. Sties and shelters should be closely boarded to exclude draughts, provision at the same time being made for adequate ventilation. Floors should be above ground level to prevent dampness and a bedding of straw or similar material should be provided. Where floors are constructed of concrete, wooden sleeping platforms should be supplied. It should be recognised that the exposure of young pigs particularly suckers and weaners to damp cold conditions is an important predisposing factor in the development of infectious pneumonia and that the protection of the young animals from these unfavourable influences represents a valuable control measure.

Sanitation.

The piggery should be constructed on a dry, well-drained site, low lying areas being avoided. Sties, shelters and yards should be maintained in a clean hygienic condition, litter and droppings being regularly gathered up and removed. Young pigs should be given free range and allowed to run in small paddocks where they can obtain access to green feed in preference to being confined to sties and small yards which may become boggy and insanitary, particularly during winter. Provided adequate shelters are provided pigs carried on the free range system remain healthier and are more thrifty than those confined in sties or yards.

Feeding.

The diet should be adequate both in quantity and quality. A balanced ration which will provide a sufficiency of proteins, minerals and vitamins should be fed. The ration available will usually consist of grain and this will be utilised to the greatest advantage if crushed or ground. A protein supplement such as skim milk or meat meal must be added to the grain ration. According to their size skim milk at the rate of a half to one gallon per head daily will provide the animals with their protein requirements, but even if less than this amount is available its addition to the ration will still prove of decided advantage. When it is necessary to rely upon meat meal as a source of protein this should form ten per cent. of the ration, one part of meat meal being mixed with nine parts of crushed wheat. In addition when wheat is being fed a mineral supplement is necessary and this may be provided by the addition of ground limestone or slaked lime at the rate of one pound per one hundred pounds of grain. Finally green feed which will provide the animals with their vitamin A requirements thus increasing their resistance to infection, should always be made available, and if this cannot be obtained by grazing a supply should be cut and fed to the pigs daily.

Young pigs should be encouraged to feed at an early age. By the provision of a creep or small enclosure to which the young pigs can gain access, through a small entrance, but from which the sow is excluded, they will commence to feed when about three weeks old, and are able to fend for themselves when subsequently weaned at the age of eight to ten weeks. This will obviate the severe check which young pigs commonly suffer at the time of weaning and which renders them particularly vulnerable to infection.

Careful attention to the details outlined above will maintain the resistance of the animals at a high level enabling them to withstand infection, and this will provide the most effective means of controlling the disease.

In addition precautions should be taken to prevent the introduction of infection from an outside source. Pig raisers should endeavour to breed their own requirements. Should the purchase of additional pigs become necessary a careful inspection should be made, when any animals showing evidence of coughing, laboured respiration or unthriftiness should be rejected. Newly purchased pigs should be isolated for a period of three weeks, before being allowed to come into contact with other pigs on the property. In this connection the possibility of healthy pigs developing the disease through exposure to unfavourable weather conditions during transit or from contact with cold, wet cement floors while they are held in the sale yards cannot be overlooked. The introduction of breeding sows, which may be carriers of infection, from properties upon which the disease is known to exist should be avoided.

When an outbreak of infectious pneumonia occurs on a property, pigs which are still healthy should be separated from those showing symptoms of the disease and removed to clean quarters. The affected pigs should be held in isolation until they can be sold or disposed of for slaughter. Faults of management and feeding should be corrected. Severely affected animals which are stunted and unthrifty should be destroyed. The growth and development of such animals is so retarded that they are never profitable to maintain.

Photosensitisation.

B. BIGNOLD, Government Veterinary Surgeon.

INTRODUCTION.

PHOTOSENSITISATION is the name given to a disease of animals (and man) in which the white or lightly pigmented areas of skin become extremely sensitive to sunlight. Exposure of such sensitised areas to the direct or indirect rays of the sun causes great pain, severe inflammation of the skin and often sloughing of its superficial layers.

CAUSE.

The immediate cause of photosensitisation is the presence in the blood of photodynamic pigments, that is, pigments which absorb and transform sun rays, with the production of irritant substances.

Light can reach blood in superficial vessels if the overlying skin is free from pigment, i.e., white. Hence for the production of the disease there must be photodynamic pigments in the blood of a white or partly white animal exposed to sunlight.

The conditions under which photodynamic pigments appear in the blood vary.

Firstly, the green colouring matter of plants (chlorophyll) is changed during digestion to a photodynamic pigment, phylloerythrin. After absorption this pigment is short circuited by the liver and excreted in the bile, before it is able to get into the general circulation.

If, however, the liver is unable to perform this normal function, phylloerythrin will get into the general circulation, and photosensitisation will result. This is apparently what happens in facial eczema, a serious disease in New Zealand and other countries. The liver is damaged by some toxin not yet isolated, which prevents the excretion of phylloerthrin and so causes photosensitivity.

Another consequence of the liver damage is the retention of bile, which causes jaundice to appear also.

Secondly, some plants, e.g., St. John's Wort contain photodynamic pigments which pass through a normal liver. Photosensitisation in such cases, not being due to liver damage, is not accompanied by jaundice.

From the fact that outbreaks frequently occur when green feed first comes away in quantity after a dry spell, it seems likely that the liver of an animal which has long been on dry feed, when suddenly given abundant green stuff, is temporarily unable to deal with all the phylloerythrin absorbed. Some gets past the liver into the general circulation, and photosensitivity results.

Thirdly, for completeness sake, a very rare condition known as bovine congenital porphyrinurea should be mentioned. Animals with this inherited defect are unable to deal with pigments in the normal manner, and suffer persistent photosensitisation.

There is still much to be learnt about the precise mechanism of the production of photosensitivity, but the above outline will probably not need to be much amended by future work.

ANIMALS SUSCEPTIBLE.

Cattle, sheep, horses and pigs are known to be susceptible, as well as goats and some experimental animals and man.

In cattle, Friesians and Guernseys, which often have white patches, are usually affected. Other breeds also may show lesions on the udder and muzzle.

White faced sheep commonly suffer, and any breed if recently shorn is susceptible.

Fig. 1.
Showing swollen face and ears.
(Photo: *Onderstepoort J.*)

In horses the "blaze" down the face is often scalded, as well as body patches, on pie- and skew-balds. Figure 4 illustrates such a case very well.

Pigs are rarely affected, only one outbreak being recorded, in Large Whites.

These things lend colour to the common belief that in horses and cattle at least, unpigmented skin is abnormal skin, a show point not found in primitive stock, and a definite weakness.

CONDITIONS UNDER WHICH OUTBREAKS OCCUR.

A great amount of work has and is being done on the climatic, meteorological and pasture conditions under which losses occur.

From a consideration of the cause as outlined above, it is evident that outbreaks are most likely to occur after the first rains when green feed becomes available. The disease occurs in W.A. from June to September in most years.

If, however, liver damage (cirrhosis) already exists, as in many sheep which have had non-fatal doses of various poison plants, green feed plus sunlight may be expected to produce the trouble at any time of year.

A great variety of plants have been associated with outbreaks. Clovers, trefoils, buckwheat, *Tribulus terrestris* (Caltrops) and many others occurring in W.A. are regarded as dangerous. The disease also appears at times where the only pasture available is ordinary grasses.

Evidently, under suitable conditions, practically any green plant can produce the disease.

Fig. 2.
Sheep flinching in sunlight.
(Photo: *Onderstepoort J.*)

SYMPTOMS.

Sheep.

The animals first stamp their feet, shake the head and move about restlessly. The head is rubbed against fences. Pain may be so severe that the animal becomes violent and frantic. If the back is affected, as in shorn sheep, the animal flinches and crouches down as in Figure 2.

Shade is sought after, the head being thrust into bushes, or against fence posts or against other sheep.

Then swelling of the affected skin appears, the ears get thickened and droop (see Figure 1), the eyelids, face and lips enlarged. Such an appearance may be confused with swelled head in rams (see this *Journal*, September, 1945) but the latter condition is confined to rams and invariably fatal.

Clear straw-coloured fluid oozes from the affected surfaces and crusts form. Rubbing the part may cause abrasions.

In a few days the superficial layers of skin become dead and dry, and separate from the underlying layers which are thereby protected from further damage and the irritation subsides. In two or three weeks the necrotic (dead) layers of skin peel off, leaving the new skin beneath from which hair and wool grows again.

If the conditions are still suitable, a further scalding of the same area may occur.

These changes may or may not be accompanied by jaundice. If this condition is present, the mucous membrane of the eye will be tinged yellow.

There is severe loss of condition and in some cases death.

Fig. 3.
Skin sloughing on Friesian heifer.

(Photo: *B. Bignold.*)

Cattle.

The symptoms are much like those in sheep. There is a sudden drop in milk yield, the cow licks the affected parts, which include the udder, escutcheon, muzzle, eyelids and any white areas. Irritation is apparently less severe than in sheep.

The lesions are remarkably discreet; for example a strip of white only half an inch wide may peel off leaving the surrounding dark skin unaffected.

If the udder is badly burnt, mastitis of a severe type may supervene.

Jaundice may or may not be present.

Figure 3 shows a denuded area with the sloughed skin still hanging to the leg by a few hairs. The new skin is still covered by a scab.

Horses.

In horses the symptoms are much like those seen in cattle.

Fig. 4.
Skin sloughing on piebald horse.
(Photo: *Udall's Vet. Medicine.*)

POST MORTEM.

Animals dying or killed while suffering from photosensitisation show the skin changes just described. Also, in cases where liver damage has occurred, this organ is found to be tough, fibrous and in old cases shrunken. The surfaces are finely mottled (as in a normal pig's liver) and often green or yellow-green in colour.

If liver changes have occurred, jaundice will also be present, the tissues of the body generally being more or less coloured by the yellow bile pigments.

TREATMENT.

Suitable treatment will be obvious from a consideration of the cause. Any of the following measures alone or together, will be effective.

(1) *Shade.*—Sky shine as well as sunshine can cause irritation, hence tall trees do not give protection. Sheep and cattle may be confined in shearing sheds or barns in the day time and allowed to graze at night.

(2) *Dry Feed.*—The trouble will subside if green feed can be removed from the diet.

(3) *Protective Paints.*—In small outbreaks it may be found convenient to use a protective paint. Any dark coloured application may be used, which will not irritate the skin, damage the wool, be washed out by rain or poisonous to an animal licking it.

A strong solution of Condy's Crystals, which darken the hair or wool after drying, is suitable in many cases.

PREVENTION.

As the onset of the disease is usually sudden and often unpredictable, preventive measures are not very practical. The owner should be prepared to adopt a suitable treatment at the first sign of trouble.

Grasshoppers and Locusts in Western Australia.

C. F. H. Jenkins, Government Entomologist.

INTRODUCTION.

GRASSHOPPERS and locusts are amongst the most ancient enemies of the farmer for they figured prominently in Biblical times, and periodically throughout the ages have devastated crops in all parts of the world.

The term grasshopper covers a wide range of insects differing greatly in size and habits, but characterised by the fact that they are vegetable feeders and have the hind legs especially developed for jumping. There are many different species of grasshoppers and locusts in Western Australia, but the difference between the two groups is not generally understood.

When conditions are suitable, the species usually termed locusts are much more gregarious or social in their habits than grasshoppers, and may undertake long migratory flights of several hundred miles.

In south Western Australia, although several species of true locusts occur, including a form of the world-famous migratory locust, conditions are not favourable to swarm development, and so fortunately only scattered individuals are encountered.

In addition to the distinction between locusts and grasshoppers which is based more upon habits than structure, there is also to be observed the difference between the short-horned grasshoppers (Acridiidae), and the long-horned grasshoppers (Tettigoniidae). The common names are more or less descriptive in that the antennae or feelers of the short-horned varieties are short and moderately broad, whereas in the long-horned group, the antennae may be almost hair-like in thickness and exceed the entire body of the insect in length.

THE SMALL PLAGUE GRASSHOPPER (*Austroicetes cruciata* Sauss).

The most important grasshopper in Western Australia is the small plague grasshopper of the drier wheatbelt districts. A general description of this pest and its habits may be regarded as typical of the other short-horned species.

Description.

The female measures a little over an inch in length, and is mottled brown in general colouration. The male is noticeably smaller than the female, and the forewings are mottled with light and dark brown. The most striking feature about the mature males is the bright yellow tinge on the body and legs. The hind wings in both sexes are clear and transparent.

Life History.

The grasshopper lays its eggs in almost any kind of soil providing it is compact and free from dense cover. The female bores into the ground by means of hardened chitinous valves situated at the end of the abdomen, and a frothy substance is exuded as a lubricant during the operation, and to form a lining to the egg pod.

About 20 eggs are laid in each pod, and it is characteristic of this species that a large group of males usually cluster around the ovipositing female. The eggs are yellowish white in colour and crescent shaped. Egg laying takes place in the spring, and the eggs survive the summer to hatch about July or August, when sufficiently moistened by the winter rains.

When it first issues from the egg, the young grasshopper moults or sheds a tight-fitting white skin, and is then capable of hopping about like its parent. At this stage, however, it is rather smaller than a housefly and dark in colour. It feeds voraciously upon almost any available weeds, and increases in size by a series of moults, until maturity is reached about October.

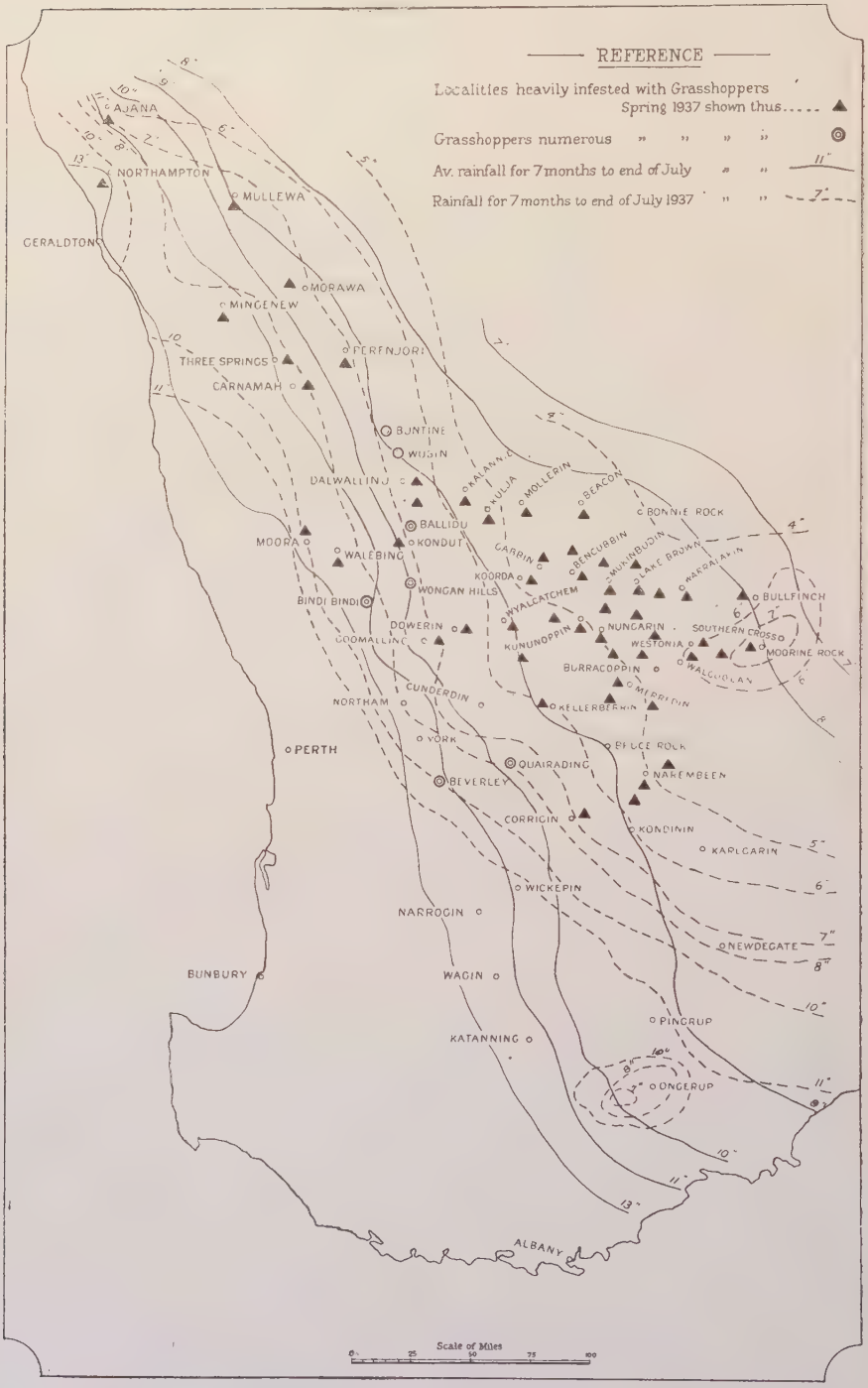
Egg laying is then performed and the adults die.

Hatched egg-pod of the small plague grasshopper showing soil cap and moulted "skins" of nymphs.
(After A. D. Cocks.)

The little plague grasshopper is not present in the wetter areas of the south-west, but its place there is filled by a number of other species of local importance.

FACTORS INFLUENCING THE OCCURRENCE OF PLAGUE OUTBREAKS IN WESTERN AUSTRALIA.

A study of the climatic conditions for the plague years shows that the rainfall was light and this appears to have had a favourable influence upon the hatching and development of the insects. Another factor, however, has had a very important bearing upon the incidence of grasshoppers in these areas. Following the financial depression of 1929, much land which had been normally kept under cultivation was allowed to lie idle. The effect of low prices was accentuated by a succession of drought years, and this led to a general decline in agricultural activities in all districts, but more particularly in those areas where the margin of safety was least evident. In the boom years preceding the depression, agriculture in Western Australia spread at a very rapid rate and extensive clearing took place in all parts of the wheatbelt. Grasshoppers had always been present in these areas in small numbers, but forest and scrub country was not favourable to their multiplication and food was relatively scarce. The clearing of the country exposed vast areas suitable for egg laying and the grass which this land supported provided an ample food supply for the increasing insect population. As long as high prices and good seasons stimulated farming activities, the menace of these potential breeding grounds was not apparent, and reserves, ringbarked areas, roadsides, etc., were the only places where hoppers appeared. When, however, following depression and drought, abandoned farms became numerous, the grasshopper problem became one of paramount importance. The large areas of land left idle in most cases did not revert to bush again, and were of such a nature, that the longer they were left untouched, the less herbage they supported, thus yearly increasing the breeding grounds available for the pest.



Distribution of grasshopper swarms in 1937.

The problem as it exists in this State is by no means unique. The same species of grasshopper constitutes a comparable problem in South Australia. Furthermore, the following quotation from the "Journal of Economic Entomology for 1940" shows that the same difficulties are being faced in the United States of America:—

"Agricultural conditions of recent years and recently adopted agricultural practices have greatly increased the amount of abandoned and reverted land in certain areas. Thus in North Dakota in 1938 there were more than 4 million acres of idle crop land listed among farms participating in the agricultural adjustment programme. This amounts to nearly 18 per cent. of the total crop land acreage of the State. This abandonment has occurred along with our extensive outbreaks of grasshoppers of recent years, so it is natural to suspect that the two facts might represent a cause and effect relationship."

OUTBREAKS OF THE LITTLE PLAGUE GRASSHOPPER IN WESTERN AUSTRALIA.

As far back as August, 1922, swarms of grasshoppers were reported from Kununoppin, Nungarin and Merredin in the north-eastern wheatbelt and isolated outbreaks were recorded from these areas almost yearly up to 1934.

In 1935, quite a widespread plague was experienced and the pest increased annually until in 1937 almost the entire wheat areas were affected.

A slight decline occurred in 1938 and the good season of 1939 saw little grasshopper damage done.

The numbers have fluctuated periodically since 1940, the two worst years to date being 1942 and 1944. Grasshoppers were prevalent in many areas during 1945 but the unusually wet winter was very favourable to crop and feed growth in the outer wheatbelt and little serious grasshopper damage was reported.

GOVERNMENT EXPENDITURE ON GRASSHOPPER CONTROL.

The widespread nature of grasshopper outbreaks and their dependence upon factors largely outside the control of the individual have caused them to be treated as a national problem by the Governments of many countries.

Ever since 1935 the Western Australian Government has made baiting material available free to farmers in affected areas, the only conditions being that the distribution of the material is supervised by the local road board and that only mixed bait is given to individual farmers.

In 1937 a comprehensive ploughing scheme was inaugurated under which ploughing contracts were let for the cultivation of egg beds on reverted Agricultural Bank properties at the rate of 5s. per acre. 72,000 acres were treated that year and in subsequent years further ploughing has been encouraged.

To ensure that the benefits derived from the ploughing of abandoned areas would not be stultified by invasion from neglected occupied holdings a grant of 2s. 6d. per acre was voted in 1943 for the treatment of breeding grounds on occupied farms, and the carrying out of summer cultivation was also approved.

Since 1935 over £66,000 has been spent by the Government on ploughing and bait distribution, and approximately 293,000 acres have been broken up under the grasshopper control scheme.

Manpower shortages during the war years have restricted baiting activities, but in 1937, 716 tons of bran were distributed and over the past 11 years, approximately 1,700 tons of bran, over 300 tons of molasses and over 50 tons of arsenite of soda have been made available free to farmers in the grasshopper belt.

CONTROL MEASURES.

Cultural Methods.

Heavy timber growth and a profusion of ground cover are unfavourable for the breeding of the small plague grasshopper and consequently the needless clearing and ring-barking of land in the grasshopper belt are to be deprecated. Every effort should be made to cultivate hard bare soil so as to destroy eggs already laid and to render the area unattractive to the next swarm of laying adults.

Typical grasshopper country, north-eastern wheat belt.

Summer cultivation with fixed tyne cultivators after egg laying is completed is quite effective and is favoured in certain districts where labour and other difficulties may reduce the amount of grasshopper ploughing possible during the seeding and fallowing periods.

Baiting and Spraying.

Non-poisonous Sprays.—As a contact spray, carbolic or washing soap used at the rate of 2½ ozs. to a gallon of hot water, is very effective against young hoppers.

Poison Sprays.—(1) Arsenite of soda, 1 lb.; molasses, 4 lbs.; water, 14 gallons.

This spray kills both by contact, due to the absorption of arsenic through the body integument of the insect, and also by the ingestion of sprayed foliage. It is particularly effective against young hoppers where green herbage is plentiful as is often the case early in the season. It should not be applied to cultivated crops of any kind as most plants would be severely burned by the spray.

(2) Arsenate of lead powder, 1 oz., or arsenate of lead paste, 2 oz.; water, 1 gallon.

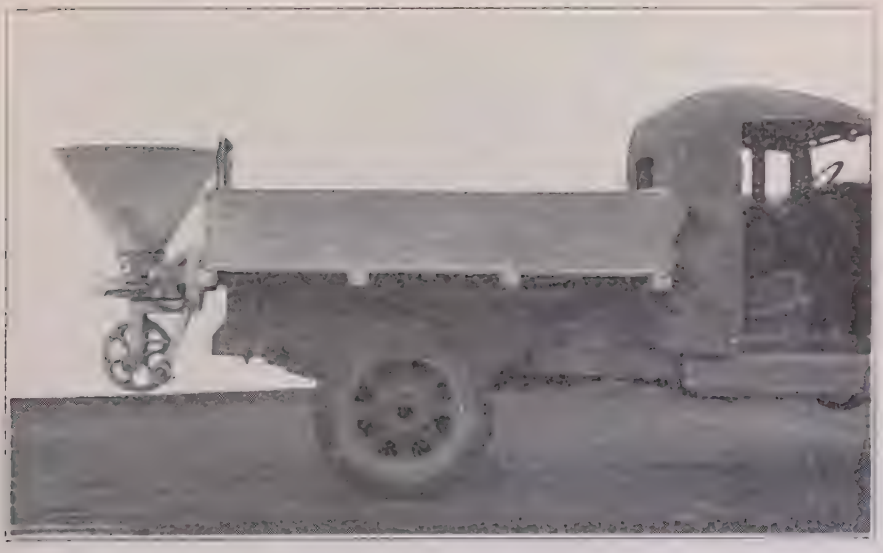
This spray will not injure plants and may be applied safely to vegetables and fruit trees suffering from grasshopper attack. This mixture should be kept agitated when in use as the poison is insoluble in water and will settle on standing.

WARNING:—When fruit and vegetables are sprayed, they should be thoroughly washed to remove all traces of poison before being used as food.

Poison Bait.—Bran, 25 lbs.; arsenite of soda, ½ lb. (80 per cent. arsenious oxide); molasses, 6 lbs.; water, 2½ gallons.

The above amount is sufficient to treat one acre. The arsenite of soda should be dissolved in water, likewise the molasses; the two should then be thoroughly mixed into the bran with sufficient additional water to make a moist crumbling

Power driven bait-mixer.



Bait-spreader attached to truck.

mash. The amount of water required to bring this about may vary with different samples of bran, but it is essential that the mixture should not become too wet, otherwise it will become lumpy and correct distribution will be impossible.

It is best to thoroughly mix the ingredients and gradually add the water, rather than pour in the estimated quantity all at once, as an even mixture is difficult to obtain if the latter procedure is followed. Unless a broadcaster such as is described below is to be used, the bait is best laid by hand, the mixture being thrown into the wind with a flick of the wrist so as to ensure that it will fall in fine particles. Baiting should be done in the early morning before the hoppers have commenced feeding.

Spreader showing revolving plate and veins for throwing bait.

Mechanical Distributors.

During the 1936 campaign in the Narembeen Road Board area, it was demonstrated that the poison bait could be effectively distributed per medium of super-spreaders. Two of these machines were brought into use on the property of Mr. W. N. Hedges. They were mounted on motor lorries and driven by a cog chain

connected to the back wheel of the motor truck. The distribution of the bait by this means ensured that it was scattered in the necessary fine particles, lumps being impossible. Mr. Hedges also devised a means of mechanically mixing the baiting ingredients.

This consisted of a circular drum or tank, which rotated about an axle fitted with a number of fixed arms or agitators. The tank was rotated by a belt attached to a small motor. By the use of these methods, much labour and man-handling of the baiting material is eliminated. In subsequent campaigns broadcasters have been used in almost all districts with great success and have proved themselves the most effective means of baiting large areas of country.

Danger to Stock.

Lumpy bait is a constant menace to stock just as long as the lumps remain. If the bait is laid carefully, there is little or no danger to stock, but as a precaution it is advisable to remove stock from poisoned paddocks for a fortnight or three weeks. Experiments conducted by the New South Wales Department of Agriculture have shown that where the spray is used, no danger to stock is incurred even if they are allowed immediate access to treated herbage.

Mixing Precautions.

When mixing arsenical solutions, care should be taken to keep the hands as free from the substance as possible, otherwise sores may result. Smearing the hands with grease of any kind before commencing operations will greatly minimise this danger. All receptacles should be carefully washed after having been used for mixing purposes.

OTHER GRASSHOPPERS AND LOCUSTS OF IMPORTANCE IN WESTERN AUSTRALIA.

Although the little plague grasshopper is by far the most important grasshopper pest in Western Australia, quite a number of other species can become troublesome. Some of the commoner are briefly dealt with, and the control measures already outlined will be found applicable in one form or another to all the local species.

The Australian Plague Locust (*Chortoicetes terminifera* Walk.).

This locust is of primary importance in the Eastern States where it assumes plague proportions. In Western Australia it is numerous in the summer months, often attacking vegetables and garden flowers. It is larger than the species already described, and may be brownish or green in colour. The extremities of the otherwise clear hind wings are tipped with black.

Its breeding habits are generally similar to those of the previous species, but several generations may occur in one year if weather conditions are suitable.

The Wingless Grasshopper (*Phaulacridium vittatum* Sjost.).

This is a small grasshopper, uniform grey or brown in colour, and with many individuals almost wingless.

It is common in many districts around Perth and the lower South-West and unlike the grasshopper of the wheatbelt, breeds quite freely in sand. Damage is sometimes done to market gardens, flower gardens and fruit trees, but the plagues are always strictly local, as the majority, even of the adults, are wingless.

The Australian plague locust.

(After A. D. Cocks.)

The small plague grasshopper.

(After A. D. Cocks.)

The Yellow Winged Locust (*Gastrimargus musicus* Fabr.).

This species is a large thick-set grasshopper, easily recognised by the conspicuous black and yellow colouring of the hind wings.

The favourite haunts of this insect are grassy paddocks supporting a wealth of couch or paspalum. On this account, it is commonly seen during the summer months in the Harvey-Waroona irrigation districts and along river flats.

The yellow winged locust is an important pest in the summer rainfall areas of the north and periodic plagues occur during the summer months to devastate homestead gardens and other cultivated produce.

The Spur-throated Locust (*Austracris guttulosa* Walk.).

This is a large brown locust about 2½ inches in length which is fairly common in many parts of the South-West but never in plague swarms. Like the yellow winged locust and the migratory locust, however, it swarms in the more northern regions and in June last, was reported doing serious damage to banana plantations at Carnarvon. The habits of this locust differ greatly from those of the wheatbelt grasshopper as the adult is a much longer lived insect.

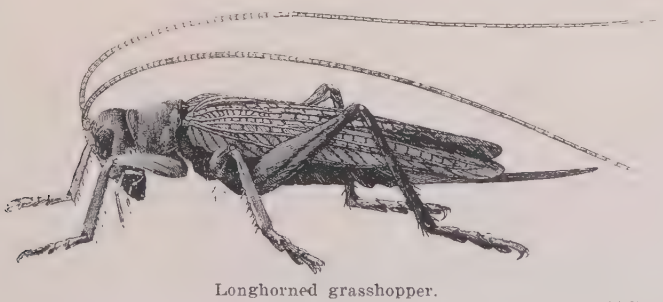
Egg laying which takes place at night occurs about December or January and the eggs hatch soon after.

The winged adults feed voraciously on a wide range of plants including eucalypts, bananas and citrus. The winter months are passed in the adult stage, when the insects sometimes cluster in large masses in the tree tops almost like swarms of bees.

Long-horned Grasshoppers.

The long-horned grasshoppers differ considerably in habits from the short-horned species and are by no means of equal economic importance.

The ovipositor or egg laying apparatus of the female "long-horn" is usually long and sword-like, although not invariably so. The eggs are usually placed in rows along the edges of leaves, but some species lay them in the ground.



Longhorned grasshopper.

(After Frogatt.)

The long-horned grasshoppers, although often numerous enough to cause annoyance, cannot be regarded as serious economic pests in this State. They may cause damage to ripening fruit and being usually more arboreal in their habits than the "short-horns" are less susceptible than the latter to poison baits. Arsenate of lead sprays, however may be used with satisfactory results.

The Official Australian Pure Bred Dairy Cattle Recording Scheme.

M. Cullity, Superintendent of Dairying, and B. H. Drakes.

It is necessary yet again to draw attention to the fact that relatively few of our pure-bred herds have been submitted for test. Some improvement in this respect has taken place compared to 1943-44 inasmuch as there were four more herds tested in the period under review. A total of 25 herds were recorded. In all 384 cows were entered for test but owing to various reasons, principally associated with the very dry spring of 1944, 40 were withdrawn before being tested 150 days. These have not been included in the averages.

The dry spring and therefore abnormally long period without succulent feed also contributed to a comparatively large number not completing the 273 days test period. Of the 344 cows included in the averages, 84 did not milk for the full period. The cows which did complete the full 273 days, averaged 317.4 lbs. fat compared to 289.4 lbs. for all cows testing more than 150 days.

While due allowance must be made for the effect of the season and the cumulative effect of four years of reduced superphosphate top-dressing, disappointment must be expressed at the low average results, particularly in certain herds to which it has been customary to look for high yields.

However, some consolation rests in the thought that it has been possible for breeders to maintain interest in testing during the war years, particularly when many were adversely affected by shortages of manpower, and the difficulty of procuring sufficient supplies of fodder and concentrates at periods of the year.

The average production of all cows for each year since 1934-35 is shown in Table 1.

Table 1.

PURE-BRED HERDS, 1934–45.

Year.	No. of Cows Completing Test.	Average Butter Fat per Cow.
		lb.
1934–35	305	320·26
1935–36	367	297·17
1936–37	319	300·87
1937–38	333	298·08
1938–39	375	292·40
1939–40	382	305·88
1940–41	372	298·38
1941–42	290	322·84
1942–43	294	321·27
1943–44	289	331·67
1944–45	344	317·42

As would be expected there is also a decline in the percentage of cows passing standard as will be noted from Table 2.

This decline is not even over all breeds. As in the previous year the Jersey breeders have achieved the greatest success with 72.2 per cent. of their cows passing standard. The numbers of Shorthorns and Guernseys producing up to standard were 52.5 per cent. and 43.4 per cent. respectively, representing declines of 5.3 per cent. and 8.7 per cent. respectively, when compared with 1943-44.

TABLE 2.
PERCENTAGE OF COWS PASSING STANDARD.

Year.	Australian Illawarra Shorthorn.	Guernsey.	Jersey.	Total.
	%	%	%	%
1937–38	59·1	68·7	35·6	53·1
1938–39	53·8	71·4	55·2	57·9
1939–40	48·0	77·5	64·2	59·2
1940–41	52·0	61·0	51·0	54·0
1941–42	73·1	68·3	59·7	68·3
1942–43	67·6	67·9	55·0	64·3
1943–44	57·8	52·1	73·3	61·9
1944–45	52·5	43·4	72·2	57·3

These figures should cause concern to breeders, as while giving all due allowance because of the seasonal conditions and hardship, the performances of the cows are far too low for herds from which bulls are supplied to commercial dairymen.

As mentioned in previous reports, the commercial dairy farmer of this State accepts the view that he should endeavour to improve his herd by using standard bulls, that is pure-bred bulls, the progeny of cows which have passed the standard of their age class. In addition to the use of herd-recording as a means of procuring information regarding the relative performances of the various cows in the herds, there is some obligation on breeders to show that their cows are of really good quality, thus giving some guarantee to prospective purchasers that bulls from these herds would be satisfactory in getting high yielding daughters.

It is also necessary to refer again to the large number of breeders of bulls sold for use in commercial herds who have never submitted their herds for test. Still again there must be concern at the large number of bulls sold from herds which are not used strictly for dairying, but only as a means of breeding bulls for sale. It is suggested that the Breed Societies consider this matter very seriously with a view to encouraging more widespread testing.

In some countries consideration has been given to the possibility of making herd-book registration contingent on the production of yield certificates for the near female parents.

The number of cows passing standard in each age class is shown in Table 3. Here again reference must be made to the relatively good performance of the Jersey cows.

In Table 4, in which is set out the average production of each age class for each breed, it will be seen that with the exception of the mature class, the Jerseys have the highest averages in all classes.

Table 5, which is published for the first time, allows a comparison between the yield of cows for each breed and age class for all cows and those which have completed a full 273-day test period.

Of the 344 cows whose productions have been included in this report, only 260 completed the full period. In other words, approximately 25 per cent. of the cows did not continue in milk for the full period. While it is important for commercial dairymen that their cows have a lactation of approximately 10 months, it is still more important that breeders of sires for these herds concentrate on cows which have the capacity of milking for this period. Failure to keep the cow in milk may be due to reasons other than the cow's incapacity, but the latter is the reason which would be applied by the prospective purchaser.

Table 3.
COWS PASSING STANDARD.

Age Class.	A.I.S.		Guernsey.		Jersey.		All Breeds.	
	No. of Cows Tested.	No. Passing Standard.	No. of Cows Tested.	No. Passing Standard.	No. of Cows Tested.	No. Passing Standard.	No. of Cows Tested.	No. Passing Standard.
Mature	27	11	24	10	19	8	70	29
Senior 4 years	9	3	3	1	7	7	19	11
Junior 4 years	11	2	10	3	13	9	34	14
Senior 3 years	10	2	5	2	10	9	25	13
Junior 3 years	18	8	7	4	15	11	40	23
Senior 2 years	28	20	8	3	23	15	59	38
Junior 2 years	57	38	12	7	28	24	97	69
Total	160	84	69	30	115	83	344	197
Percentage	52·5		43·4		72·2		57·3	

Table 4.
AVERAGE BUTTER FAT PRODUCTION IN EACH CLASS.

Age Class.	A.I.S.			Guernsey.		Jersey.		All Breeds.	
	Standard.	No. of Cows.	Average Butter Fat.	No. of Cows.	Average Butter Fat.	No. of Cows.	Average Butter Fat.	No. of Cows.	Average Butter Fat.
	lb.		lb.		lb.		lb.		lb.
Mature	350	27	335·97	24	336·25	19	318·02	70	331·19
Senior 4 years	330	9	322·36	3	292·12	7	368·52	19	334·59
Junior 4 years	310	11	263·86	10	294·49	13	351·47	34	306·36
Senior 3 years	290	10	240·48	5	291·64	10	359·05	25	300·54
Junior 3 years	270	18	249·22	7	272·35	15	352·42	40	291·97
Senior 2 years	250	28	280·98	8	264·50	23	275·09	59	276·45
Junior 2 years	230	57	236·75	12	208·00	28	294·85	97	249·96
		160		69		115		344	

New Records.

While conditions were not favourable for high production, three records were broken during the year. All of these were for the Jersey breed.

Jersey—Junior 4-year-old. *"Camden Ariadne,"* owned by Mr. C. E. Kruger of Pinjarra, produced 8,764 lbs. milk, average test 6.84 per cent. and 600.32 lbs. of butter-fat in 273 days.

The previous record was held by "Camden Circe," also owned by Mr. Kruger, who produced 9,265 lbs. milk, average test 6.28 per cent., and 582.55 lbs. butter-fat.

"Camden Ariadne" holds both the Junior 3- and Junior 4-year-old records for her breed.

Both "Camden Ariadne" and "Camden Circe" are by "Greenmount Golden Sultan."

Jersey—Junior 2-year-old. Two records were established for this class. *"Juadine Peerless Lily 20th,"* owned by Miss L. G. Hancock, Harvey, produced 7,212 lbs. milk, average test 6.01 per cent., 434.14 lbs. butter-fat in 273 days, thus surpassing the record of "Grass Vale Topsy," owned by R. H. Rose & Son, established in the previous season of 8,191 lbs. milk, average test 5.23 per cent., 425.13 lbs. butter-fat.

Later in the year, *"Grass Vale Northwood Eve,"* also owned by R. H. Rose & Son, broke the record established by "Juadine Peerless Lily 20th," by producing 7,755 lbs. milk, average test 5.81 per cent. and 451.23 lbs. butter-fat in 273 days.

The leading sire for the year was "Mornemoot Northwood's Beau," whose 16 daughters under test produced an average of 371.5 lbs. butter-fat, equivalent to 470.6 lbs. on a mature basis.

The three leading sires are shown in Table 6.

In Table 7 are shown the yields of all cows tested during the year.

TABLE 5.

COMPARATIVE TABLE SHOWING AVERAGE PRODUCTION IN EACH AGE CLASS OF COWS UNDER TEST 150 DAYS OR OVER AND COWS COMPLETING 273 DAYS.

Age Class.	Standard Butter Fat.	A.I.S.				Jersey.			
		No. of Cows Tested 150 days or over.	Average Butter Fat.	No. of Cows Completing 273 days.	Average Butter Fat.	No. of Cows Tested 150 days or over.	Average Butter Fat.	No. of Cows Completing 273 days.	Average Butter Fat.
	lb.		lb.		lb.		lb.		lb.
Mature	350	27	335·97	17	384·26	19	318·02	13	355·91
Senior 4 years	330	9	322·36	3	505·42	7	368·52	7	368·52
Junior 4 years	310	11	263·86	8	280·49	13	351·47	9	411·22
Senior 3 years	290	10	240·48	5	286·42	10	359·06	10	359·06
Junior 3 years	270	18	249·22	9	281·14	15	352·42	14	355·98
Senior 2 years	250	28	280·98	19	321·70	23	275·09	17	306·42
Junior 2 years	230	57	236·75	44	263·94	28	294·85	26	306·41

Age Class.	Standard Butter Fat.	Guernsey.				All Breeds.			
		No. of Cows Tested 150 days or over.	Average Butter Fat.	No. of Cows Completing 273 days.	Average Butter Fat.	No. of Cows Tested 150 days or over.	Average Butter Fat.	No. of Cows Completing 273 days.	Average Butter Fat.
	lb.		lb.		lb.		lb.		lb.
Mature	350	24	336·25	22	341·70	70	331·19	52	359·17
Senior 4 years	330	3	292·12	3	292·12	19	334·59	13	382·48
Junior 4 years	310	10	294·49	7	332·23	34	306·36	24	344·61
Senior 3 years	290	5	291·64	5	291·64	25	300·54	20	324·04
Junior 3 years	270	7	272·35	5	301·61	40	291·97	28	322·22
Senior 2 years	250	8	264·50	8	264·50	59	276·45	44	305·40
Junior 2 years	230	12	208·00	9	231·65	97	249·96	79	274·24

TABLE 6.

THREE LEADING SIRES.

Name of Bull.	Owner.	Sire.	Dam.	Average Production of Six Best Daughters.		Number of Daughters.	Average Production.	
				Without Allowances.	With Allowances.		Without Allowances.	With Allowances.
				lb. Butter fat.	lb. Butter fat.		lb. Butter fat.	lb. Butter fat.
Mornmoot Northwood Beau (Jersey) (17798)	R. H. Rose & Sons	Glen Iris Golden Beau (14629)	Mornmoot Northwood Madeira 7th (63202)	436·22	553·78	16	371·50	470·62
Grass Vale Gold Boy (Jersey) (14684)	do. do.	Belgonia Gold Boy (12458)	Grass Vale Lady Fowler 17th (48536)	434·54	492·12	8	404·34	464·90
Austral Park Wonderful Standard (Jersey) (12423)	Miss L. G. Hancock	Ellerdale Wonderful Masterman (11561)	Ellerdale Wonder's Golden (47992)	413·87	476·93	7	401·35	458 66

TABLE 7

COWS WHICH COMPLETED TEST DURING THE TWELVE MONTHS ENDED 30TH JUNE, 1945.

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk Last Day of Test.	Weight of Milk for Period.	Average Test.	Weight of Butter Fat for Period.	Owner.	Sire.
						lbs.	lbs.	%	lbs.		
COWS UNDER 2½ YEARS OLD—STANDARD 230LBS BUTTERFAT											
Grass Vale Northwood Eve	Jersey	...	3-7-42	6-8-44	273	25	7,755	5·81	451·23	R. H. Rose & Son ...	Mornmoot Northwood Beau (17798
Juadine Peerless Lily 20th	do.	...	10-12-41	2-5-44	273	24	7,212	6·01	434·14	Miss L. G. Hancock ...	Austral Park Wonderful Standard (12423)
Juadine Peerless Lily 19th	do.	...	26-10-41	27-4-44	273	26	6,948	6·23	432·91	Miss L. G. Hancock ...	Austral Park Wonderful Standard (12423)
Grass Vale Buttercup 11th	do.	....	5-7-42	31-3-44	273	20	6,660	6·06	403·94	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Grass Vale Buttercup 9th	do.	....	24-5-41	31-10-43	273	22	6,966	5·70	397·41	R. H. Rose & Son	Grass Vale Gold Boy (14684)
Grass Vale Lady Fowler 37th	do.	....	21-8-42	21-8-44	273	16	6,198	5·82	360·91	R. H. Rose & Son ...	Mornmoot Northwood Beau (17798)
Camden Biddy	do.	...	1-7-42	19-8-44	273	13·5	6,580	5·31	349·63	Mrs. A. G. Eckersley	Greenmount Golden Bobbie (18578)
Grass Vale Magnolia 4th	do.	86645	23-11-41	21-10-43	273	14	6,117	5·60	343·00	R. H. Rose & Son ...	Mornmoot Northwood Beau (17798)
Claremont Whitby Maid 48th	A.I.S.	....	8-1-42	17-3-44	273	30	8,550	3·93	336·81	Claremont Hospital for Insane	Westby Monarch (5404)
Claremont Poppy 25th	do.	....	10-2-42	15-4-44	273	27	8,061	4·09	329·77	Claremont Hospital for Insane	Westby Monarch (5404)
Grass Vale Norawood ...	Jersey	...	27-6-42	24-8-44	273	6	5,568	5·77	321·56	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Grass Vale Lady Fowler 36th	do.	....	28-5-42	7-4-44	273	16	5,958	5·31	316·88	R. H. Rose & Son	Grass Vale Gold Boy (14684)
Wooroloo Vanity	A.I.S.	41211	12-8-41	25-11-43	273	21	6,753	4·67	315·49	Wooroloo Sanatorium Farm	Wooroloo Red Baron (6412)
Claremont Treasure 31st	do.	....	23-1-42	4-6-44	273	26	7,428	4·13	307·27	Claremont Hospital for Insane	Claremont Pompous (4690)
Carbanup Esther	do.	....	18-2-42	15-7-44	273	3	7,329	4·16	305·16	D. H. Bell	Glanavon Maestro (4833)
Wooroloo Wynette	do.	41212	2-4-42	13-3-44	273	13	7,059	4·27	302·07	Wooroloo Sanatorium Farm	Wooroloo Red Baron (6412)
Claremont Clara 17th	do.	....	3-1-42	25-4-44	273	26	7,218	4·18	302·04	Claremont Hospital for Insane	Westby Monarch (5404)
Claremont Clara 18th	do.	....	20-3-42	27-6-44	273	20	7,410	4·06	301·55	Claremont Hospital for Insane	Claremont Pompous (4690)
Claremont Poppy 26th	do.	....	2-7-42	30-9-44	273	29	7,647	3·91	299·32	Claremont Hospital for Insane	Westby Monarch (5404)
Tipperary Beauty 16th	do.	....	22-11-42	9-4-44	273	17	6,681	4·44	296·77	W. G. Burges	Tipperary Ace (6336)
Kapara Dairymaid	Jersey	...	24-6-42	20-5-44	273	18	5,874	5·03	295·69	D. Bradford	Congelin Mandarin (14542)
Norinya Nita	do.	...	3-9-41	29-11-43	273	15	5,685	5·18	294·62	Mrs. A. G. Eckersley	Navua Royal Star (15869)
Claremont Mabel 21st	A.I.S.	....	3-9-41	25-11-43	273	26	7,458	3·94	294·49	Claremont Hospital for Insane	Westby Monarch (5404)
Glanavon Pink Pearl 5th	do.	36573	16-8-41	10-12-43	273	12	7,356	3·94	290·49	D. Bevan & Sons	Tipperary President (5335)
Claremont Cocky 21st	do.	....	20-8-41	30-12-43	273	25	7,155	4·04	289·77	Claremont Hospital for Insane	Wooroloo Triumph 4th (3527)
Claremont Belle 31st	do.	....	8-12-41	1-3-44	273	21	6,753	4·25	287·61	Claremont Hospital for Insane	Wooroloo Triumph 4th (3627)
Denmark Dame 2nd	Guernsey	10289	6-11-41	6-1-41	273	20	5,490	5·18	284·79	Denmark Research Station	Denmark Lady's Goldseeker (4799)

Norinya Nada	Jersey	....	10-11-41	28-11-43	273	20·5	6,106	4·64	283·76	Mrs. A. G. Eckersley	Navua Royal Star (15869)
Radyr Park Dorothy 20th	do.	....	17-6-42	7-8-44	273	9	6,102	4·65	283·76	L. M. Temple	Navua September Lad (14023)
Wooroloo Patsy	A.I.S.	....	9-9-42	27-9-44	273	14	6,312	4·48	283·06	Wooroloo Sanatorium Farm	Berry Rufus 2nd (6570)
Claremont Lily 10th	do.	....	3-2-42	15-5-44	273	23	6,939	4·07	282·63	Claremont Hospital for Insane	Claremont Pompous (4690)
Glanavon Rosina 5th	do.	....	16-8-41	30-9-43	273	7	6,471	4·32	279·90	D. Bevan & Sons	Newstead Triumph (3420)
Claremont Star 28th	do.	....	22-10-41	1-3-44	273	20	6,780	4·08	277·15	Claremont Hospital for Insane	Claremont Max Hero (3802)
Travalgan Lady Eion 13th	Jersey	....	11-6 42	21-6 44	273	10	4,620	5·89	272·51	W. H. & T. F. Robinson	Orphanage Douglas (18919)
Glanavon Picture 7th	A.I.S.	....	29 10-41	2-1-44	273	16	5,658	4·81	272·39	D. Bevan & Sons ..	Blackland's Jean's Supreme (1871)
Glanavon Golden Girl 6th	do.	36555	17-9-41	18-12-43	273	13	6,879	3·94	271·58	D. Bevan & Sons ..	Newstead Triumph (3420)
Mereworth Oxford Buttercup	Jersey	....	18-6-42	28-8-44	273	11	6,498	4·17	271·58	B. Langridge ..	Clarendon Eyre Oxford Pioneer (11484)
Denmark Ace's Rose	Guernsey	10284	29-11-41	10-1-44	273	18	5,724	4·73	270·89	Denmark Research Station	Homestead Ace (Imp.) (1631)
Kapara Velveteen	Jersey	....	23-5-42	7-6 44	273	13·5	5,740	4·71	270·59	D. Bradford	Congelin Mandarin (14542)
Denmark Lady Diana 2nd	Guernsey	....	29-10-42	25-6-44	273	9	4,437	6·03	267·68	Denmark Research Station	Denmark Dawn's Apollo (4785)
Kapara Happy Days	Jersey	....	3-12 41	24 3 44	273	15·5	4,786	5·78	267·07	D. Bradford	Grantham Easter Oxford (14677)
Wooroloo Heatherbell 2nd	A.I.S.	....	11-9 42	25-9 44	273	11	6,033	4·42	266·85	Wooroloo Sanatorium Farm	Berry Rufus 2nd (6570)
Claremont Cherry 28th .. .	do.	....	25-2-42	24 4 44	273	20	6,420	4·14	265·80	Claremont Hospital for Insane	Westby Monarch (5404)
Korigekup Lady Morn	Jersey	....	20-4-42	2-5-44	273	11·5	4,519	5·82	263·25	Mrs. A. G. Eckersley	Mornmoot Northwood Beau (17798)
Wattle Creek Bertha	A.I.S.	....	5-12-42	19-9-44	273	18	5,994	4·38	263·08	E. T. Thatcher ..	Wooroloo Royal Standard (6414)
Woorcloo Doreen 5th	do.	41176	22-3 42	14-3-44	273	17	6,141	4·26	261·92	Wooroloo Sanatorium Farm	Berry Rufus 2nd (6570)
Eungella Miss Muffet	Jersey	....	5-5-42	18-6-44	273	7	5 031	5·20	261·88	D. G. Spark	Travalgan Starbright King (18129)
Claremont Clarrie 2nd	A.I.S.	....	17-8-41	14-11-43	273	24	6,822	3·73	255·04	Claremont Hospital for Insane	Westby Monarch (5404)
Carbanup Eliza	do.	....	7-5-42	21-6-44	273	2	6,456	3·91	252·47	D. H. Bell	Glanavon Maestro (4833)
Denmark Mary's Bonnie	Guernsey	10295	22-7-41	4-12-43	273	19	5,037	5·00	252·34	Denmark Research Station	Denmark Lady's Goldseeker (4799)
Claremont Biddy 62nd	A.I.S.	....	10-6-42	22-8-44	273	21	6,423	3·92	251·80	Claremont Hospital for Insane	Westby Monarch (5404)
Grass Vale Lady Fowler 38th	Jersey	....	1-9-42	16-8-44	273	4	4,782	5·26	251·60	R. H. Rose & Son ...	Mornmoot Northwood Beau (17798)
Glanavon Rita	A.I.S.	....	15-9-41	10-10-43	273	15	6,255	4·00	250·46	D. Bevan & Sons ..	Blacklands Jean's Supreme (1871)
Inverell Violet	do.	....	23-9-42	10-8-44	273	10	6,330	3·94	249·76	W. G. Burges ...	Liberton Venturer 2nd (7132)
Glanavon Esmeralda 3rd	do.	....	10-11-41	16-10-43	273	17	5,826	4·28	249·63	D. Bevan & Sons	Blacklands Jean's Supreme (1871)
Wattle Creek Florrie	do.	....	16-5-42	4-9-44	273	15	5,685	4·38	249·13	E. T. Thatcher ..	Wattle Creek Duchess' Monarch (5399)
Glanavon Princess	do.	....	26-12-41	26-12-43	273	16	6,258	3·95	247·47	D. Bevan & Sons	Blacklands Jean's Supreme (1871)
Wattle Creek Vida	do.	....	9-8-42	23-6-44	273	12	5,826	4·24	247·29	E. T. Thatcher	Wattle Creek Duchess' Monarch (5399)
Glanavon Greta 4th	do.	....	25-12-41	5-4-44	273	14	6,162	4·00	247·00	D. Bevan & Sons	Glanavon Guthrie (5743)
Travalgan Lady Eion 12th	Jersey	....	24-5-42	17-6-44	273	11	4,353	5·60	243·91	W. H. & T. F. Robinson	Orphanage Cuba (17913)
Glanavon Spangle 2nd	A.I.S.	....	25-7-41	14-10-43	273	13	5,499	4·51	242·24	D. Bevan & Sons	Blacklands Monarch's Commander (1877)
Kapara Sparkle's Lassie 2nd	Jersey	....	14-10-42	30-6-44	273	17·5	5,377	4·47	240·69	D. Bradford	Congelin Jolly Eminent 3rd (18425)
Denmark Ace's Velda	Guernsey	10285	16-11-41	13-12-43	273	15	4,740	5·04	238·92	Denmark Research Station	Homestead Ace (Imp.) (1631)
Brookfields Bon Ton	do.	....	3-5-42	10-7-44	273	12·5	4,597	5·11	235·15	P. G. Hampshire & Son	Brookfields Bulwark (5627)
Kapara Duchess	Jersey	....	14-9-42	30-6-44	273	8	4,509	5·17	233·13	D. Bradford	Congelin Mandarin (14542)

HERD TESTING—*continued.*

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk Last Day of Test.	Weight of Milk for Period.	Average Test.	Weight of Butter Fat for Period.	Owner.	Sire.
						lb.	lb.	%	lb.		
Glanavon Goldilocks	A.I.S.	....	11-2-42	9-4-44	273	9	5,907	3·93	232·29	D. Bevan & Sons	Tipperary President (5335)
Glanavon Thelma 4th	do.	....	31-10-41	20-10-43	273	12	5 756	4·41	232·24	D. Bevan & Sons	Blacklands Jean's Supreme (1871)
Tralvagan Starbright 18th	Jersey	...	2-6-42	3-7-44	273	9	4,077	5·62	229·53	W. H. & T. F. Robinson	Orphanage Douglas (18919)
Glanavon Melba 5th	A.I.S.	....	16-4-42	9-9 44	273	12	5,796	3·93	228·15	D. Bevan & Sons	Newstead Triumph (3420)
Wooroloo Dasher	do.	41174	23-2-42	6-4-44	273	7	4,881	4·55	222·34	Wooroloo Sanatorium Farm	Wooroloo Red Baron (6412)
Wooroloo Sunlady 4th	do.	41210	15-3-42	15-3-44	273	16	5,238	4·23	222·02	Wooroloo Sanatorium Farm	Berry Rufus 2nd (6570)
Travalgan Lady Eion 15th	Jersey	..	25-7-42	15-7-44	273	7	3.966	5·30	210·37	W. H. & T. F. Robinson	Orphanage Douglas (18919)
Mereworth Butter Queen 5th	do.	....	22-5-42	18-6-44	240	13·5	4.725	4·37	206·52	B. Langridge ...	Clarendon Eyre Oxford Pioneer (11484)
Brookfields Pixie	Guernsey	10073	15-5-41	17-11-43	273	10·5	4,186	4·85	203·31	P. G. Hampshire & Son	Yarraview Clarinet 2nd (4629)
Tipperary Dove 21st	A.I.S.	....	14-4-42	13-4-44	273	11	4,893	4·11	201·11	W. G. Burges ..	Tipperary Ace (6336)
Glanavon Goldilocks 3rd ...	do.	..	23-11-41	16-10-43	273	13	4 959	3·97	197·41	D. Bevan & Sons	Newstead Triumph (3420)
Travalgan Lady Eion 14th ...	Jersey	....	11-6-42	7-7-44	273	9	5.067	3·86	195·75	W. H. & T. F. Robinson	Travalgan Oxford's King (19160)
Travalgan Lady Eion 16th ...	do.	....	3-9-42	30-6-44	273	7	3.471	5·51	191·50	W. H. & T. F. Robinson	Glen Iris Golden Oxford (12694)
Glanavon Charmer 2nd	A.I.S.	....	22-12-41	17-2-44	240	15	4.740	3·92	185·88	D. Bevan & Sons ..	Blacklands Monarch's Commander (1877)
Glanavon Sunbeam 16th	do.	..	28-10-41	8-11-43	240	7	4,410	4·14	182·73	D. Bevan & Sons ..	Blacklands Jean's Supreme (1871)
Glanavon Gold 5th	do.	....	10-3-42	14-3-44	273	11	4,413	4·11	181·50	D. Bevan & Sons ..	Newstead Triumph (3420)
Glanavon Mayflower 3rd	do.	...	5-11-41	26-1-44	273	11	4,263	4·02	171·40	D. Bevan & Sons	Blacklands Jean's Supreme (1871)
Glanavon Dahlia 14th	do.	....	14-3-42	27-7-44	210	12	4,215	4·03	170·25	D. Bevan & Sons	Boacklands Jean's Supreme (1871)
Muresk Gay	Guernsey	....	29-3-43	22-9-44	273	6	3,348	4·95	165·94	Muresk Agricultural College	Koojan Ideal's Dictator (4167)
Muresk Gwenda	do.	....	3-5-43	16-9-44	273	8	3,564	4·65	165·87	Muresk Agricultural College	Koojan Ideal's Dictator (4167)
Muresk Delanthia	do.	....	2-6-42	31-8 44	240	7	3,600	4·48	161·31	Muresk Agricultural College	Muresk Arthur (4338)
Glanavon Thelma 5th	A.I.S.	....	31-3-42	26-8-44	210	9	3,870	4·02	155·91	D. Bevan & Sons	Blacklands Jean's Supreme (1871)
Glanavon Daphne 8th	do.	..	14-4-42	7-8-44	210	11	3,810	4·03	153·57	D. Bevan & Sons	Newstead Triumph (3420)
Glanavon Doris 14th	do.	....	21-5-42	19-9-44	180	10	3,570	4·05	144·75	D. Bevan & Sons	Newstead Triumph (3420)
Glanavon Buttercup 7th	do.	....	17-3-42	7-9-44	180	10	3,660	3·94	144·24	D. Bevan & Sons	Blacklands Monarch's Commander (1877)
Glanavon Dahlia 15th	do.	..	30-4-42	9-8-44	210	9	3,510	4·00	140·40	D. Bevan & Sons	Blacklands Monarch's Commander (1877)
Brookfields Faith 8th	Guernsey	10066	20-8-41	12-12-43	240	9	2,985	4·65	138·96	P. G. Hampshire & Son	Brookfields Baronet (4712)
Glanavon Golden Girl 7th	A.I.S.	....	5-8-42	3-9-44	180	10	3,570	3·87	138·51	D. Bevan & Sons	Newstead Triumph (3420)
Glanavon Pansy 6th	do.	....	24-4-42	3-8-44	210	6	3,600	3·83	138·12	D. Bevan & Sons	Newstead Triumph (3420)
Claremont Maggie 18th	do	....	26-7-42	7-10-44	120	30	3,330	3·81	127·17	Claremont Hospital for Insane	Westby Masterpiece (5403)
Glanavon Gold 6th	do.	....	6-1-43	5-9-44	180	9	3,270	3·88	127·02	D. Bevan & Sons	Newstead Triumph (3420)
Glanavon Goldilocks 5th	do.	....	10-10-42	10-9-44	180	10	2,730	4·19	114·60	D. Bevan & Sons	Glanavon Federal (6869)

Muresk Anna	Guernsey	11058	28-9-42	12-9-44	180	7	2,490	4·45	110·88	Muresk Agricultural College	Koojan Ideal's Dictator (4167)
Maxwell Buttercup	do.	....	20-7-42	15-10-44	120	10	2,010	5·28	106·32	P. Berridge	Moongi Oliver (502)
Glanavon Fairy 7th ...	A.I.S.	....	25-5-42	20-11-44	120	12	2,190	4·32	94·80	D. Bevan & Sons	Tipperary President (5335)
Tipperary Dove 20th	do.	....	5-12-41	7-4-44	150	6	2,070	4·11	85·17	W. G. Burges	Liberton Venturer (4983)
Claremont Mabel 23rd	do.	....	17-12-41	17-3-44	90	20	2,100	4·02	84·54	Claremont Hospital for Insane	Claremont Pompous (4690)
Grantham Silvermine 3rd	Jersey	....	9-8-42	26-11-44	150	9	2,025	4·08	82·68	J. A. Sears	Rosecliffe Marchalong (15094)
Claremont Blossom 41st	A.I.S.	....	13-7-42	10-10-44	90	21	2,100	3·84	80·64	Claremont Hospital for Insane	Wesby Masterpiece (5403)
Narrogin Dinah	do.	....	21-7-42	17-1-45	120	9·5	1,830	4·38	80·31	Narrogin School of Agriculture	Tipperary Amy's Mascot (6338)
Glanavon Ettie 4th	do.	....	18-10-42	20-12-44	120	10	2,010	3·83	77·10	D. Bevan & Sons	Glanavon Federal (6869)
Maxwell Pride	Guernsey	....	10-9-42	7-10-44	120	6	1,470	5·24	77·04	P. Berridge	Moongi Oliver (1495)
Glanavon Ramona 2nd	A.I.S.	....	13-8-42	21-11-44	120	11	1,770	3·85	68·16	D. Bevan & Sons	Glanavon Trevor (6881)
Denmark Jonquil 2nd	Guernsey	10294	19-7-42	10-12-44	60	21	1,380	4·93	68·16	Denmark Research Station	Denmark Rosette's Dictator (4804)
Brookfield's Babette ...	do.	....	20-11-42	14-10-44	60	19	1,140	5·35	61·08	P. G. Hampshire & Son	Yarraview Clarinet 2nd (4629)
Carbanup Ena	A.I.S.	....	25-2-42	24-6-44	90	17	1,590	3·80	60·54	D. H. Bell	Glanavon Maestro (4833)
Muresk Mariette	Guernsey	....	26-3-42	2-6-44	90	9	870	6·22	54·12	Muresk Agricultural College	Muresk Arthur (4338)
Muresk Rosenthal	do.	....	2-5-42	6-9-44	90	6	1,110	4·70	52·20	Muresk Agricultural College	Muresk Arthur (4338)
Glanavon Esmeralda 4th	A.I.S.	....	16-11-42	26-12-44	90	11	1,200	4·13	49·62	D. Bevan & Sons	Blackland's Monarch's Commander (1877)
Muresk Mayfus	Guernsey	....	9-1-43	19-9-44	90	6	750	4·80	36·30	Muresk Agricultural College	Koojan Ideal's Dictator (4167)
Maxwell Golden Primrose	do.	....	7-7-42	2-10-44	30	22	660	4·00	26·40	P. Berridge	Moongi Oliver (1495)

COWS 2½ YEARS OLD AND UNDER 3 YEARS—STANDARD 250 LB. BUTTER-FAT.

Capel Tiny	A.I.S.	35382	9-6-41	24-5-44	273	16	13,098	3·95	517·72	W. H. Doyle & Son	Capel Star King (4672)
Capel Princess 7th	do.	35376	9-6-41	24-2-44	273	33	10,089	4·20	424·05	W. H. Doyle & Son	Capel Lottie's Reward (3782)
Capel Dairymaid's Pretty	do.	35367	1-8-41	23-5-44	273	24	11,112	3·74	415·88	W. H. Doyle & Son	Monks Green Chummy (5971)
Denmark Ace's Dawn 2nd	Guernsey	10282	22-11-41	3-10-44	273	19	7,347	5·56	408·75	Denmark Research Station	Homestead Ace (Imp.) (1631)
Capel Fairy 2nd	A.I.S.	35368	10-8-41	9-6-44	273	25	9,120	4·47	407·97	W. H. Doyle & Son	Valliere Commodore (6360)
Grass Vale Lady Fowler 33rd	Jersey	....	7-7-41	5-4-44	273	20	6,870	5·64	387·77	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Kapara Rosebud	do.	....	8-6-41	1-6-44	273	20	7,470	5·11	381·93	D. Bradford	Congelin Mandarin (14542)
Grass Vale Nora's Maid	do.	....	9-9-41	5-9-44	273	10	6,810	5·37	365·87	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Capel Spotted Rose	A.I.S.	35379	6-8-41	13-5-44	273	21	9,033	4·02	363·48	W. H. Doyle & Son	Monks Green Chummy (5971)
Grass Vale Lady Fowler 34th	Jersey	....	19-8-41	27-3-44	273	16	6,438	5·63	362·71	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Grass Vale Magnolia 3rd	do.	....	13-8-41	8-4-44	273	19	5,967	5·96	355·67	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Grass Vale Magnolia 4th	do.	86645	23-11-41	8-9-44	240	8	6,300	5·71	342·96	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Glanavon Penelope 3rd	A.I.S.	36569	4-4-41	29-10-43	273	21	8,148	4·20	342·77	D. Bevan & Son	Blacklands Jean's Supreme (1871)
Grass Vale Golden Cream 25th	Jersey	....	7-5-41	6-4-44	273	14	5,592	6·11	341·74	R. H. Rose & Son	Grass Vale Gold Boy (14684)
Denmark Ace's Dame	Guernsey	10280	29-11-41	30-9-44	273	12	6,276	5·31	333·32	Denmark Research Station	Homestead Ace (Imp.) (1631)
Glanavon Nancy 5th	A.I.S.	36568	29-12-40	18-10-43	273	26	7,428	4·47	332·55	E. T. Thatcher	Blacklands Jean's Supreme (1871)
Grass Vale Northwood Nora	Jersey	86646	23-5-41	22-2-44	273	14	5,052	6·57	332·31	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Eungella Dark Venus	do.	....	18-5-41	22-4-44	273	8	6,279	5·07	318·93	D. G. Spark	Travalgan Starbright King (18129)
Capel Model 8th	A.I.S.	35372	8-11-41	20-5-44	240	14	7,905	3·99	315·78	W. H. Doyle & Son	Monks Green Chummy (5971)
Eungella Bonetta	Jersey	....	17-5-41	23-4-44	273	9	5,457	5·73	312·87	D. G. Spark	Travalgan Starbright King (18129)
Travalgan Starbright 14th	do.	89349	18-5-41	14-4-44	273	11	5,133	5·99	307·74	W. H. & T. F. Robinson	Glen Iris Golden Oxford (12694)

HERD TESTING—*continued.*

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk Last Day of Test.	Weight of Milk for Period.	Average Test.	Weight of Butter Fat for Period.	Owner.	Sire.
						lb.	lb.		lb.		
Glanavon Rep[illegible]	A.I.S.	36575	4–12–40	11–10–43	273	17	7,170	4·20	301·32	D. Bevan & Sons	Tipperary President (5335)
Wooroloo Lady May	do.	41194	24–1–41	5–12–43	273	26	6,858	4·34	297·93	Wooroloo Sanatorium Farm	Wooroloo Triumph's Heir (4493)
Radyr Park June 2nd	Jersey	88645	16–5–41	10–3–44	273	17	5,931	4·92	292·28	L. M. Temple	Navua Coronation Star (14929)
Narrogin Dolly	A.I.S.	38669	20–8–41	1–6–44	240	13·5	6,645	4·32	287·64	Narrogin School of Agriculture	Westby Masterpiece (5403)
Carbanup Doris	do.	35389	3–8–41	12–7–44	273	14	7,242	3·96	287·44	D. H. Bell	Glanavon Maestro (4833)
Glanavon Doris 12th	do.	36540	17–2–41	19–12–43	273	10	7,050	4·04	285·23	D. Bevan & Sons	Tipperary President (5533)
Wooroloo Doreen 4th	do.	41175	2–4–41	25–12–43	273	18	6,414	4·41	283·02	Wooroloo Sanatorium Farm	Wooroloo Red Lad (5418)
Maxwell Baronia	Guernsey	10858	8–7–41	8–7–44	273	8	4,959	5·66	281·12	P. Berridge	Moongi Oliver (1495)
Capel Fussy	A.I.S.	35370	30–8–41	22–5–44	150	46	6,660	4·18	278·58	W. H. Doyle & Son	Capel Star King (4672)
Wattle Creek Buttercup	do.	....	5–1–42	19–7–44	273	12	6,876	4·04	278·32	E. T. Thatcher	Wooroloo Royal Standard (6414)
Radyr Park October Star	Jersey	....	18–10–41	8–8–44	273	9	4,827	5·71	275·93	L. M. Temple	Navua Coronation Star (14929)
Tipperary Lovely 5th	A.I.S.	40645	10–6–41	11–6–44	273	10	6,300	4·30	271·15	W. G. Burges	Tipperary Ace (6336)
Capel Green Princess . .	do.	35371	22–8–41	13–5–44	240	8	6,330	4·27	270·48	W. H. Doyle & Son	Monks Green Chummy (5971)
Tipperary Dove 18th	do.	40638	8–8–41	17–5–44	273	11	6,753	3·94	266·23	W. G. Burges	Tipperary Ace (6336)
Radyr Park Dorothy 16th	Jersey	88643	4–6–41	28–3–44	273	11·5	4,909	5·24	257·63	L. M. Temple	Navua Coronation Star (14929)
Radyr Park Dorothy 14th	do.	....	22–4–41	28–12–43	273	14	5,187	4·94	256·58	L. M. Temple	Navua September Lad (14023)
Tipperary Peggy 2nd	A.I.S.	40650	10–7–41	20–5–44	273	7	6,381	3·82	244·39	W. G. Burges	Tipperary Ace (6336)
Radyr Park Clarionette 5th	Jersey	88641	17–7–41	20–7–44	273	6	4,353	5·54	241·31	L. M. Temple	Navua September Lad (14023)
Narrogin Colleen	A.I.S.	38665	22–8–41	15–4–44	273	12	5,526	4·34	239·85	Narrogin School of Agriculture	Westby Masterpiece (5403)
Wattle Creek Ruby	do.	....	1–11–41	12–8–44	273	9	5,307	4·47	237·28	E. T. Thatcher	Wooroloo Royal Standard (6414)
Brookfields Queen 10th	Guernsey	10078	19–11–41	17–8–44	273	8	4,674	5·05	236·17	P. G. Hampshire & Son	Yarraview Clarinet (4628)
Lockridge Susie 00	do.	10820	25–11–41	1–9–44	273	11	3,588	6·28	225·53	P. G. Hampshire & Son	Koojan Beau Geste (4964)
Capel Beauty	A.I.S.	35365	15–6–41	30–5–44	210	13	5,580	3·89	217·35	W. H. Doyle & Son	Valliere Commodore (6360)
Muresk Diamond Lass	Guernsey	11064	28–10–41	12–5–44	273	11	4,203	5·13	215·78	Muresk Agricultural College	Denmark Damon (2519)
Brookfields Prunella	do.	10075	19–12–40	9–11–43	273	13·5	4,630	4·52	209·65	P. G. Hampshire & Son	Brookfields Baron (3936)
Travalgan Lady Eicn 11th	Jersey	89348	22–10–41	3–7–44	273	7	5,226	3·97	207·65	W. H. & T. F. Robinson	Orphanage Cuba (17913)
Brookfields Faith 6th	Guernsey	10064	6–5–41	14–12–43	273	11	3,918	5·25	205·71	P. G. Hampshire & Son	Brookfields Broadcaster (4719)
Grantham Silvermine	Jersey	....	9–9–41	12–9–44	240	4·5	3,780	5·04	190·53	J. A. Sears	Rosecliffe Marchalong (15904)
Glanavon Buttercup 5th	A.I.S.	36530	19–1–41	20–12–43	180	8	4,620	3·94	182·04	D. Bevan & Sons	Tipperary President (5335)
Glanavon Esmeralda 3rd	do.	....	10–11–41	16–10–44	180	13	3,960	4·25	168·33	D. Bevan & Sons	Blacklands Jean's Supreme (1871)
Grantham Lovely Carnation	Jersey	....	23–2–42	3–8–44	180	10	2,955	5·18	153·12	J. A. Sears	Rosecliffe Marchalong (15904)
Grantham Easter Rye 13th	do.	....	9–3–42	6–10–44	210	13	2,910	5·15	150·15	J. A. Sears	Rosecliffe Marchalong (15904)
Grantham Beautiful Carnation	do.	....	3–2 42	31–8–44	180	10	2,535	5·65	143·43	J. A. Sears	Rosecliffe Marchalong (15904)
Tipperary Maggie 8th	A.I.S.	40648	1–9–41	3–4–44	210	5	3,300	4·33	143·07	W. G. Burges	Liberton Venturer (4988)
Grantham March Fairy 2nd	Jersey	....	29–10–41	28–9–44	150	11	2,760	4·99	137·76	J. A. Sears	Rosecliffe Marchalong (15094)
Brookfields Morden Lady 5th	Guernsey	10071	20–10–41	23–10–44	120	8	2,475	5·31	131·43	P. G. Hampshire & Son	Yarraview Clarinet 2nd (4629)
Glanavon Princess	A.I.S.	....	26–12–41	8–11–44	150	11	3,120	4·10	127·95	D. Bevan & Sons	Blacklands Jean's Supreme (1871)
Tipperary Dove 19th	do.	40639	9–10–41	15–4–44	150	6	1,890	4·22	79·80	W. G. Burges	Liberton Venturer (4988)

Glanavon Tiny 12th	A.I.S.	....	5-5-42	6-1-45	90	10	1,170	3·86	45·21	D. Bevan & Sons	Newstead Triumph (3420)
Capel Bracken Rose	do.	35366	17-8-41	28-5-44	30	34	1,020	4·31	44·04	W. H. Doyle & Son	Capel Lottie's Reward (3782)
Planarbor Hetty	do.	....	6-1-42	14-12-44	120	7	1,155	3·78	43·77	Mrs. V. Alexander	Glanavon Genius (3957)

COWS 3 YEARS OLD AND UNDER 3½ YEARS—STANDARD 270 LB. BUTTER-FAT

Grass Vale Buttercup 9th	Jersey	....	24-5-41	6-10-44	273	25	8,205	5·94	487·72	R. H. Rose & Son	Grass Vale Gold Boy (14684)
Grass Vale Topsy	do.	86647	11-8 41	9 9-44	240	33	9,300	5·12	476·88	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Grass Vale Buttercup 10th	do.	86642	18-8-41	1-9-44	273	14	8,532	5·57	475·88	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Grass Vale Lady Fowler 32nd	do.	86644	11-6-41	1-9-44	273	18	8,094	5·54	448·52	R. H. Rose & Son	Mornmoot Northwood Beau (17798)
Crantock Starbright Hyacinth	do.	....	21-7 41	30-8-44	273	20	7,290	5·75	419·90	Mrs. G. H. Burnside	Crantock Starbright's Airman (15491)
Juadine Julienne 2nd	do.	37021	26-2-41	2-6-44	273	9	7,137	5·79	413·56	Miss L. G. Hancock	Austral Park Wonderful Standard (12423)
Congelin Firefly 8th	do.	....	4-5-41	10-8-44	273	11	8,403	4·68	394·05	D. Bradford	Grantham Silvermine's Ruler (17539)
Koojan Ideal's Judith	Guernsey	10696	24-6-40	13-11-43	273	15	6,075	6·12	372·30	A. W. Padbury	Glenburnie Ideal (Imp.) (2548)
Claremont Whitby Maid 40th	A.I.S.	35578	28-5-40	21-10-43	273	26	9,258	3·99	369·49	Claremont Hospital for Insane	Westby Monarch (5404)
Congelin Iolanthe 11th	Jersey	....	21-3-41	15-8-44	273	9·5	6,028	5·78	349·02	D. Bradford	Congelin Washington (18426)
Wallatin Blue Pansy	A.I.S.	40879	2-4-41	27-6-44	240	20	8,520	3·97	338·70	W. H. Doyle & Son	Summerlea Pioneer (6240)
Denmark Golden Maria	Guernsey	8529	27-6-40	29-10-43	273	12·5	5,752	5·84	336·45	Denmark Research Station	Denmark Damaurie (4000)
Mereworth Oxford Princess 2nd	Jersey	...	24-2-41	12-8-44	273	15·5	6,676	4·65	310·46	B. Langridge	Clarendon Eyre Oxford Pioneer (11484)
Lansdowne Idomede	Guernsey	10719	4-12-40	17 2-44	273	14	5,412	5·63	305·18	A. W. Padbury	Koojan Beau Ideal (4965)
Glanavon Rosina 4th	A.I.S.	36579	24-9-40	20-11-43	273	19	7,317	4·15	304·37	D. Bevan & Sons	Blacklands Jean's Supreme (1871)
Muresk Rose Petal	Guernsey	....	13-1-40	10-4 44	120	7	1,170	5·37	62·94	Muresk Agricultural College	Muresk Homestead (2075)
Crantock Starbright's Bluebell	Jersey	..	22-3-41	28 8-44	30	28	840	4·60	38·64	Mrs. G. H. Burnside	Crantock Starbright's Airman (15491)

COWS 3½ YEARS OLD AND UNDER 4 YEARS—STANDARD 290 LB. BUTTER-FAT.

Grass Vale Silvermine	Jersey	81639	6-11-40	4-10-44	273	24	7,992	6·03	482·42	R. H. Rose & Son	Grass Vale Gold Boy (14684)
Koojan Golden Jewel	Guernsey	8805	12-3 40	25-10-43	273	18	8,064	5·90	482·30	A. W. Padbury	Koojan Beau Ideal (4965)
Congelin Iolanthe 8th	Jersey	80828	22-4 40	20-4-44	273	25·5	8,671	5·11	443·46	D. Bradford	Rosecliffe Marchalong (15094)
Grass Vale Lady Fowler 31st	do.	81634	17-8-40	26-6-44	273	11	7,893	5·58	440·48	R. H. Rose & Son	Grass Vale Gold Boy (14684)
Glanavon Glenys	A.I.S.	30591	14-10-39	28-9-43	273	22	9,726	3·89	378·36	D. Bevan & Sons	Tipperary President (5335)
Kapara Sparkle's Lassie	Jersey	82173	22 8-40	22-5-44	273	18·5	7,420	4·94	366·92	D. Bradford	Congelin V.C. (16412)
Congelin Velveteen 2nd	do.	80731	19-7-40	18-3-44	273	7·5	6,112	5·45	333·32	D. Bradford	Rosecliffe Marchalong (15094)
Congelin Happy Days 3rd	do.	85704	1 2-41	11-8-44	273	9·5	7,228	4·42	320·16	D. Bradford	Congelin Washington (18426)
Travalgan dy Eion 8th	do.	84258	19-9-40	15-6-44	273	12	5,346	5·88	314·78	W. H. & T. F. Robinson	Glen Iris Golden Oxford (12694)
Koojan Defaulter's Dixie	Guernsey	10693	18 1-41	11-8-44	273	12	5,406	5·75	311·08	A. W. Padbury	Koojan Ideal's Defaulter (4967)
Travalgan Lady Eion 7th	Jersey	89345	22-6-40	1-6-44	273	10	5,400	5·74	310·46	W. H. & T. F. Robinson	Travalgan Northern Airman (13312)
Narrogin Daisybell	A.I.S.	38668	10-10-40	22-4-44	273	7	6,501	4·68	304·76	Narrogin School of Agriculture	Westby Masterpiece (5403)
Kapara Sparkle's Victorious	Jersey	82074	16-7-40	3-6-44	273	11	5,133	5·85	300·69	D. Bradford	Rosecliffe Marchalong (15094)
Eungella Coquette	do.	81271	24-5-40	24-4-44	273	9	4,872	5·70	277·88	D. G. Spark	Greenmount Golden Sovereign (14687)
Narrogin Stella	A.I.S.	38376	19-4-40	22-4-44	273	9	6,792	4·06	276·42	Narrogin School of Agriculture	Westby Masterpiece (5403)
Wooroloo Pigeon	do.	41198	20-9-40	14-5-44	273	10	6,060	4·28	259·59	Wooroloo Sanatorium Farm	Wooroloo Triumph's Heir (4493)

HERD TESTING—*continued.*

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk Last Day of Test.	Weight of Milk for Period.	Average Test.	Weight of Butter Fat for Period.	Owner.	Sire.
						lb.	lb.		lb.		
Wooroloo Bess 2nd	A.I.S.	41170	9-8-40	31-7-44	210	11	6,120	4·18	256·11	Wooroloo Sanatorium Farm	Glanavon Genius (3957)
Denmark Briarette	Guernsey	10288	24-9-40	8-8-44	273	9	4,647	5·42	251·99	Denmark Research Station	Koojan Ideal's Dictator (4167)
Muresk Morning Glory	do.	9111	2-5-40	7-3-44	273	7	3,861	5·87	226·87	Muresk Agricultural College	Muresk Arthur (4338)
Wooroloo Netta 3rd	A.I.S.	41197	6-12-40	7-8-44	210	5	4,770	4·46	213·00	Wooroloo Sanatorium Farm	Wooroloo Red Lad (5418)
Glanavon Melba 3rd	do.	36566	11-11-40	31-7-44	150	22	4,770	4·05	193·35	D. Bevan & Sons	Blacklands Jean's Supreme (1871),
Muresk Netta	Guernsey	11071	27-11-40	1-7-44	273	9	3,537	5·25	185·97	Muresk Agricultural College	Muresk Homestead (2075)
Carbanup Constance	A.I.S.	35384	25-2-40	22-2-44	210	16	5,430	3·20	173·94	D. H. Bell	Glanavon Maestro (4833)
Glanavon Picture 5th	do.	36571	30-10-40	2-7-44	180	9	4,020	3·82	153·78	D. Bevan & Sons	Parkview Commodore (306)
Glanavon Buttercup 6th	do.	36531	17-2-41	14-11-44	150	12	2,820	3·85	108·78	D. Bevan & Sons	Blacklands Monarch's Commander (1877)
Muresk Marie	Guernsey	11069	24-9-40	13-4-44	90	6	960	4·86	46·74	Muresk Agricultural College	Denmark Damon (2519)
Grantham Lady March	Jersey	....	24-6-41	24-2-45	60	13·5	915	4·52	41·40	J. A. Sears	Rosecliffe Marchalong (15904)
COWS 4 YEARS OLD AND UNDER 4½ YEARS—STANDARD 310 LB. BUTTER-FAT.											
Camden Ariadne	Jersey	85538	10-8-40	6-10-44	273	16·5	8,764	6·84	600·32	C. E. Kruger	Greenmount Golden Sultan (14688
Camden Circe	do.	80037	24-9-40	16-10-43	273	23·5	9,265	6·28	582·55	C. E. Kruger	Greenmount Golden Sultan (14688
Denmark Jonquil	Guernsey	8536	24-4-40	31-8-44	273	15	8,295	6·17	512·21	Denmark Research Station	Koojan Beau Ideal (2965)
Juadine Sparkle's Achievement	Jersey	81992	27-9-39	17-10-43	273	25·5	10,156	4·56	463·59	Miss L. G. Hancock	Austral Park Wonderful Standard (12423)
Congelin Rose Marie 6th	do.	80830	14-4-40	30-4-44	273	22	7,596	5·91	449·23	D. Bradford	Rosecliffe Marchalong (15094)
Denmark Golden Valencia 2nd	Guernsey	8535	15-9-39	4-12-43	273	18	6,744	5·78	390·19	Denmark Research Station	Koojan Ace's Goldseeker (3431)
Tipperary Beauty 7th	A.I.S.	33565	29-7-39	6-11-43	273	26	8,628	4·34	374·48	W. G. Burges	Wooroloo Melba's Triumph (4491)
Juadine Peerless Lily 17th	Jersey	81991	18-12-39	28-4-44	273	11·5	5,884	6·31	371·59	Mrs. A. G. Eckersley	Austral Park Wonderful Standard (12423)
Mereworth Oxford Starbright	do.	....	15-5-40	14-9-44	273	7·5	6,882	5·02	346·05	B. Langridge	Clarendon Eyre Oxford Pioneer (11484)
Mereworth Oxford Silvermine	do.	87803	28-4-40	4-6-44	273	13	5,404	5·63	332·98	B. Langridge	Clarendon Eyre Oxford Pioneer (11484)
Norinya Nanette	do.	....	9-6-39	25-10-43	273	16	7,188	4·53	326·24	Mrs. A. G. Eckersley	Austral Park Wonderful Standard (12423)
Tipperary Maggie 7th	A.I.S.	40647	22-8-40	31-8-44	273	18	7,734	4·13	317·35	W. G. Burges	Liberton Venturer (4988)
Grass Vale Golden Cream 22nd	Jersey	81626	18-6-40	1-10-44	240	9	5,280	5·88	310·59	R. H. Rose & Son	Grass Vale Gold Boy (14684)
Denmark Golden Dawn 2nd	Guernsey	8527	2-4-40	3-7-44	273	10	4,950	6·26	310·24	Denmark Research Station	Koojan Ace's Goldseeker (3431)
Brookfields Queen 7th	do.	8391	23-6-40	2-9-44	273	9	5,022	6·08	305·45	P. G. Hampshire & Son	Yarraview Clarinet 2nd (4629)
Narrogin Minnie	A.I.S.	38671	25-11-39	21-4-44	273	19	7,182	4·04	290·27	Narrogin School of Agriculture	Wooroloo Sterling 3rd (6326)

Wendowie Prudence	Guernsey	11798	7–8–40	4–10–44	273	8	5,064	5·63	285 49	P. G. Hampshire & Son	Wendowie Gorgonzola (4542)
Westby Laurel	A.I.S.	40986	7–2–40	14–4–44	273	13	6,924	4·07	282·33	Narrogin School of Agriculture	Westby Searchlight (3604)
Mereworth Oxford Vanilla 2nd	Jersey	87804	15–2–40	13–6–44	273	8·5	4,630	5·76	266·71	B. Langridge	Clarendon Eyre Oxford Pioneer (11484)
Denmark Golden Maria	Guernsey	8529	27–6–40	9–10–44	273	13	5,109	5·13	262·54	Denmark Research Station	Denmark Damaurie (4000)
Narrogin Charlotte	A.I.S.	38663	13–4–40	4–7–44	210	22·5	6,750	3·86	260·73	Narrogin School of Agriculture	Westby Masterpiece (5403)
Muresk Ramona	Guernsey	9112	13–5–40	14–6–44	273	10	4,830	5·37	259·50	Muresk Agricultural College	Muresk Homestead (2075)
Glanavon Rose 2nd	A.I.S.	36577	13–11–39	4–4–44	273	4	5,952	4·13	245·92	D. Bevan & Sons	Blacklands Jean's Supreme (1871)
Tipperary Dove 14th	do.	40635	22–3–40	3–5–44	273	8	6,084	4·02	244·98	W. G. Burges	Liberton Venturee (4988)
Muresk Delicia	Guernsey	9106	15–5–40	19–8–44	240	7	5,430	4·47	242·79	Muresk Agricultural College	Denmark Damon (2519)
Mereworth Oxford Fondant	Jersey	....	11–5–40	4–6–44	273	16	4,803	4·75	228·44	B. Langridge	Clarendon Eyre Oxford Pioneer (11484)
Wooroloo Dainty 4th	A.I.S.	33984	1–1–40	6–3–44	240	9	4,785	4·69	224·70	Wooroloo Sanatorium Farm	Parkview Guardian (2557)
Narrogin Mollie	do.	38672	22–4–40	4–5–44	240	17·5	5,730	3·90	223·89	Narrogin School of Agriculture	Westby Masterpiece (5403
Narrogin Clara	do.	38664	19–3–40	9–4–44	273	6·5	6,244	3·55	221·94	Narrogin School of Agriculture	Westby Masterpiece (5403)
Glanavon Empress 4th	do.	36543	24–7–40	8–10–44	180	13	5,640	3·82	215·88	D. Bevan & Sons	Blacklands Jean's Supreme (1871)
Maxwell Red Rose 2nd	Guernsey	10863	23–6–40	5–7–44	240	8	3,525	5·41	190·98	P. Berridge	Moongi Oliver (1495)
Denmark Lady Diana	do.	8537	26–6–40	10–11–44	180	9	3,150	5·88	185·49	Denmark Research Station	Denmark Damaurie (4000)
Grantham Easter Fairy 2nd	Jersey	....	22–5–40	5–10–44	150	19·5	3,630	4·84	175·98	J. A. Sears	Grantham Easter Oxford (14677)
Mereworth Oxford Audrey	do.	87801	18–4–40	18–9–44	150	8	2,550	4·54	114·87	B. Langridge	Clarendon Eyre Oxford Pioneer (11484)
Brookfields Sonata	Guernsey	10081	1–10–40	18–3–45	60	19	1,140	3·48	39·72	P. G. Hampshire & Son	Yarraview Clarinet 2nd (4629)
Glanavon Ettie 3rd	A.I.S.	36546	19 10-40	31–1–45	30	25	750	3·90	29·31	D. Bevan & Sons	Parkview Commodore (306)

COWS 4½ YEARS OLD AND UNDER 5 YEARS—STANDARD 330 LB. BUTTER-FAT.

Wooroloo Netta 2nd ...	A.I.S.	33996	6–10–39	25–6–44	273	28	13,224	4·36	577·13	Wooroloo Sanatorium Farm	Glanavon Genius (3957)
Wooroloo Rosebud 3rd	do.	33999	29–5–39	25–5–44	273	23	11,649	4·50	524·74	Wooroloo Sanatorium Farm	Parkview Guardian (2557)
Camden Arachne	Jersey	80635	9–9–39	25–8–44	273	16	7,608	6·21	472·93	C. E. Kruger ..	Greenmount Golden Sultan (14886)
Wooroloo Bess	A.I.S.	33981	16–5–39	10–5–44	273	11	9,693	4·27	414·40	Wooroloo Sanatorium Farm	Glanavon Genius (3957)
Denmark Golden Valencia	Guernsey	8534	15–9–39	26 4–44	273	20·5	7,756	5·17	401·50	Denmark Research Station	Koojan Ace's Gold Seeker (3431)
Travalgan Lady Eion 6th ...	Jersey	79293	19–8–39	14–5–44	273	16	6,603	5·69	375·96	W. H. & T. F. Robinson	Glen Iris Golden Oxford (12694)
Juadine Jewel 2nd	do.	81987	9–10–38	9–10–43	273	14	7,332	5·01	367·43	Mrs. A. G. Eckersley	Austral Park Wonderful Standard (12423)
Camden Patsy	do.	85543	27–6–39	25–4–44	273	10·5	4,966	7·29	352·50	C. E. Kruger	Greenmount Golden Sultan (14683)
Kapara Sparkle 3rd	do.	77064	21–7–39	20–4–44	273	19·5	7,063	4·95	349·74	D. Bradford	Congelin Mandarin (14542)
Radyr Park Dorothy 10th	do.	83556	4–7–39	16–6–44	273	10	7,035	4·70	330·90	L. M. Temple	Navua Coronation Star (14929)
Radyr Park Coronation's Estrellita	do.	83555	27–7–39	28–6–44	273	10	6,105	5·40	330·17	L. M. Temple	Navua Coronation Star (14929)
Narrogin Donna	A.I.S.	32144	27–10–39	13–6–44	240	15·5	6,330	4·44	281·63	Narrogin School of Agriculture	Wooroloo Sterling 3rd (3626)

HERD TESTING—*continued.*

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk Last Day of Test.	Weight of Milk for Period.	Average Test.	Weight of Butter Fat for Period.	Owner.	Sire.
COWS 4½ YEARS OLD AND UNDER 5 YEARS—STANDARD 330 LB. BUTTER-FAT—continued.						lb.	lb.	%	lb		
Carbanup Beatrice	A.I.S.	29617	13 3-39	29 2-44	210	19	6,240	4·35	271·62	D. H. Bell	Glanavon Maestro (4833)
Muresk Angelica	Guernsey	9101	10 9-39	24-7-44	273	5	4,860	5·02	244·39	Muresk Agricultural College	Muresk Homestead (2075)
Narrogin Daisy	A.I.S.	38667	20 11-39	12-6-44	180	13	5,115	4·53	232·14	Narrogin School of Agriculture	Wooroloo Sterling 3rd (3626)
Brookfields Queen 6th	Guernsey	8390	2-3-39	30-10-43	273	7	4,821	4·70	230·47	P. G. Hampshire & Son	Brookfields Baron (3936)
Glanavon Topsy	A.I.S.	36589	27-9-39	22-5-44	180	26	6,060	3·73	226·50	D. Bevan & Sons	Tipperary President (5335)
Glanavon Maggie	do.	36562	7-8-39	12-3-44	240	9	4,830	3·90	188·70	D. Bevan & Sons	Tipperary President (5335)
Carbanup Baroness	do.	29616	15-4-39	26-2-44	150	16	4,830	3·81	184·38	D. H. Bell	Glanavon Maestro (4833)
Juadine Sparkle's Achievement	Jersey	81992	27-9-39	21-9-44	60	59	3,690	3·99	147·24	Miss L. G. Hancock	Austral Park Wonderful Standard (12423)
Carbanup Beauty	A.I.S.	....	4-3-39	4-3-44	120	11	2,400	4·27	102·48	D. H. Bell	Glanavon Maestro (4833)
Yanget Pretty Maid 4th	do.	34035	7-10-39	14-6-44	60	34	2,220	4·03	89·55	W. G. Burges	Leylands Defiance (2380)
COWS 5 YEARS OLD AND OVER—STANDARD 350 LB. BUTTER-FAT.											
Wooroloo Dainty 2nd	A.I.S.	28634	17-2-38	7-9-44	273	30	13,080	4·50	589·00	Wooroloo Sanatorium Farm	Parkview Guardian (2557)
Coogely Jonquil	Guernsey	6945	1-11-37	26-4-44	273	19·5	7,783	6·52	507·58	Denmark Research Station	Coogely Judy's Goldmine (2621)
Crantock Primula's Tulip	Jersey	70900	15-3-38	8 9-44	273	7	8,160	6·17	504·09	Mrs. G. H. Burnside	Congelin Eminent's Golden (13623)
Wooroloo Empress 2nd	A.I.S.	28639	24-11-37	1-8-44	273	25	10,935	4·49	491·37	Wooroloo Sanatorium Farm	Parkview Guardian (2557)
Wooroloo Heather 2nd	A.I.S.	28644	6-11-38	30-6-44	273	24	10,182	4·74	483·23	Wooroloo Sanatorium Farm	Parkview Guardian (2557)
Grass Vale Twylish Lady	Jersey	76604	14-10-38	26-9-44	273	24	8,232	5·55	457·48	R. H. Rose & Son	Grass Vale Gold Boy (14684)
Denmark Dame	Guernsey	6960	17-6-38	24-5-44	273	21	8,643	4·79	414·06	Denmark Research Station	Koojan Golden Prosper (2283)
Denmark Golden Dawn	do.	4118	9-1-33	4-9-44	273	18	6,924	5·97	413·84	Denmark Research Station	Koojan Golden Prosper (2283)
Eungella Bright Lass	Jersey	76185	5-8-38	20 4-44	273	15	7,395	5·59	413·67	D. G. Spark	Greenmount Bright Lad (15640)
Glanavon Rosina	A.I.S.	30603	3 5-37	6-4-44	273	9	8,367	4·85	406·09	D. Bevan & Sons	Blacklands Jean's Supreme (1871)
Glanavon Buttercup 3rd	do.	30578	17-9-38	15-10-43	273	22	10,166	3·99	405·85	D. Bevan & Sons	Glanavon Gold Boy (4830)
Narrogin Connie	do.	32143	25-8-38	27-6-44	273	23·5	9,070	4·41	400 26	Narrogin School of Agriculture	Brackenhurst Conquest (4624)
Glanavon Daphne	do.	10922	7-8-33	31 7 44	273	14	10,212	3·91	399·52	D. H. Bell	Villiers of Darbalara (2386)
Radyr Park Dorothy 5th	Jersey	68752	18-7 36	20-6 44	273	13	7,134	5·59	399·49	L. M. Temple	Greenmount Graceful Lad (7292)
Denmark Briar Rose	Guernsey	6959	15 8-37	1 5-44	273	18	7,974	4·99	398·14	Denmark Research Station	Denmark Illustrious (3320)
Radyr Park Dorothy 4th	Jersey	63850	5-10-35	25-6 44	273	16·5	8,134	4·86	395·39	L. M. Temple	Greenmount Graceful Lad (7292)
Denmark Orangebud	Guernsey	4123	9-8 32	27 10 43	273	17·5	8,017	4·87	391·12	Denmark Research Station	Koojan Golden Prosper (2283)
Claremont Whitby Maid 29th	A.I.S.	24451	12-7 37	24 10 43	273	25	9,285	4·19	389·61	Claremont Hospital for Insane	Claremont Herdsman (968)
Greenmount Bonetienne's Twinkle	Jersey	44201	24-3-33	18-4 44	273	13·5	6,805	5·52	375·97	D. G. Spark	Bellefaire Bonaparte's Bonetienne (9224)

Tipperary Gold	A.I.S.	14774	21-4-31	8 8-44	273	19	9,507	3·92	373·24	W. G. Burges	Melba's Re-Echo of Tipperary (2452)
Eungella Bopeep	Jersey	71246	27-12-37	1-5-44	273	7	7,161	5·14	368·33	D. G. Spark	Greenmount Golden Sovereign (14687)
Denmark Diana	Guernsey	6963	28-6-36	4 11-43	273	18	6,474	5·64	365·54	Denmark Research Station	Denmark Damon (2519)
Tipperary Fairy 3rd	A.I.S.	22905	1-9-36	31-10-43	273	14	9,072	4·01	364·13	W. G. Burges	Blacklands Monarch's Commander (1877)
Denmark Rosette	Guernsey	6972	21-7-36	19-11-43	273	10	6,570	5·50	361·73	Denmark Research Station	Koojan Golden Prosper (2283)
"Amy"	do.	9825	25 9-38	7 7-44	273	8	6,504	5·53	359·69	P. Berridge	Willie (6483)
Denmark Velvet	do.	8540	23-8-38	8-9-44	273	24	7,062	5·08	359·05	Denmark Research Station	Denmark Auric (3313)
Muresk Sultana	do.	7650	6-7-37	4-12 43	273	20	7,350	4·78	351·61	Muresk Agricultural College	Koojan Ace's Goldseeker (3431)
Claremont Cherry 9th	A.I.S.	15955	25-11-34	25 6-44	210	30	8,130	4·32	351·33	Narrogin School of Agriculture	Tipperary Virginia's Re-Echo (970)
Radyr Park Coronation Belle	Jersey	73600	5-7-38	5-7-44	273	10	6,660	5·27	351·26	L. M. Temple	Navua Coronation Star (14929)
Glanavon Doris 8th	A.I.S.	30586	4-12-38	24-3-44	273	15	8,955	3·89	348·67	D. Bevan & Sons	Blacklands Jean's Supreme (1871)
Koojan Ace's Dulcie	Guernsey	5658	6-3-36	11-1-44	273	21	6,273	5·54	347·82	Denmark Research Station	Homestead Ace (Imp.) (1631)
Denmark Rosebud 2nd	do.	6971	2-5 38	15-11-43	273	13	7,104	4·89	347·62	Denmark Research Station	Denmark Damon (2519)
Glanavon Pansy 5th	A.I.S.	36568	13 6-39	22 8-44	273	4	8,892	3·89	346·11	D. Bevan & Sons	Glanavon Franklin (4829)
Tipperary Beauty 6th	do.	28217	8-8-38	31-5-44	273	16	8,268	4·09	338·94	W. G. Burges	Newstead Tourist (3419)
Grass Vale Lady Fowler 29th	Jersey	81632	9-9-39	28 9-44	273	4	7,282	4·47	336·01	R. H. Rose & Son	Grass Vale Gold Boy (14684)
Denmark Angeline	Guernsey	6956	4-7-37	8-4-44	273	23	6,339	5·26	333·63	Denmark Research Station	Koojan Golden Prosper (2283)
Tabbagong Beauty 27th	A.I.S.	14413	12-8-33	13-4 44	273	20	8,040	4·08	328·59	W. G. Burges	Tabbagong Regent (2018)
Denmark Bonny Mary	Guernsey	6958	30-9-37	7-11-43	273	14	6,582	4·96	326·83	Denmark Research Station	Denmark Illustrious (3320)
Glanavon Rosina 2nd	A.I.S.	36578	17-9-38	30-9-43	273	10	8,310	3·86	321·00	D. Bevan & Sons	Glanavon Gold Boy (4830)
Mereworth Rye Buttercup	Jersey	67930	29-6-38	2 8-44	240	10	7,380	4·30	318·00	B. Langridge	Mereworth Rye Duke (13953)
Narrogin Aster	A.I.S.	32142	1-6-39	21-6-44	240	21	8,370	3·77	316·26	Narrogin School of Agriculture	Wooroloo Sterling 3rd (3626)
Red Rose	Guernsey	11313	1-9-38	6-10-44	180	11	5,550	5·58	309·78	P. Berridge	Willie (6483)
Westby Polly	A.I.S.	15141	21-5-32	18-5 44	240	21·5	7,965	3·80	304·08	Narrogin School of Agriculture	Telyarup Duke (956)
Mereworth Starbright's Vanilla 2nd	Jersey	77708	3-5-34	13-6-44	273	11·5	5,269	5·76	303·91	B. Langridge	Grantham Merry Starbright (9547)
Denmark Prosper's Lady	Guernsey	3273	6 12-31	16-10-44	273	16	5,688	5·27	299·89	Denmark Research Station	Koojan Golden Prosper (2283)
Chittering Diana	A.I.S.	19575	7-7-35	18 11-43	210	13·5	6,660	4·45	295·98	Narrogin School of Agriculture	Range Sultan (1535)
Denmark Mary Rose	Guernsey	6966	7-7-38	9-4-44	273	9	5,067	5·77	292·46	Denmark Research Station	Denmark Auric (3313)
Muresk Jessie	do.	7641	2-5-37	31-7-44	273	9	6,057	4·78	289·66	Muresk Agricultural College	Muresk Homestead (2075)
Muresk Guinevere	do.	7638	15-5-38	15-6-44	273	13	5,649	5·01	283·53	Muresk Agricultural College	Denmark Auric (3313)
Muresk Diana	do.	7634	8-7-38	3-12-43	273	9	5,667	4·99	283·27	Muresk Agricultural College	Koojan Ace's Goldseeker (3431)
Radyr Park Dorothy 7th	Jersey	73601	22-6-37	17-7-44	240	9·5	4,815	5·83	280·81	L. M. Temple	Radyr Park Estrellita's Duplex (15050)
Claremont Flora	A.I.S.	15961	27-8-34	21-4-44	273	7·5	8,362	3·33	279·29	Claremont Hospital for Insane	Claremont Herdsman (968)

HERD TESTING—*continued.*

Name of Cow.	Breed.	Herd Book No.	Date of Birth.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk Last Day of Test.	Weight of Milk for Period.	Average Test.	Weight of Butter Fat for Period.	Owner.	Sire.
						lb.	lb.		lb.		
Grantham Dreaming Carnation	Jersey	66772	20-9-37	5-7-44	273	8	5,514	5·01	276·76	B. Langridge	Clarendon Eyre Oxford Pioneer (11484)
Koojan Golden Ripple	Guernsey	7248	26-3-38	8-5-44	273	14	5,382	5·11	275·51	Denmark Research Station	Homestead Ace (Imp.) (1631)
Narrogin Maisie	A.I.S.	32146	1-11-38	18 5-44	240	13·5	6,225	4·36	271·92	Narrogin School of Agriculture	Wooroloo Sterling 3rd (3626)
Claremont Duchess 2nd	do.	9920	17-10-33	28-1-44	273	8·5	7,645	3·50	267·66	Narrogin School of Agriculture	Tipperary Virginia's Re-Echo (970)
Radyr Park June	Jersey	73603	12-6-38	30-6-44	273	6	5,238	5·02	263·00	L. M. Temple	Navua Coronation Star (14929)
Denmark Dawn Childe	Guernsey	6962	14-5-37	17-11-43	273	13	4,839	5·38	260·78	Denmark Research Station	Wollongbar Reformer (538)
Muresk Delia	do.	9105	11-5-39	30-5-44	273	7	5,551	4·57	254·12	Muresk Agricultural College	Denmark Damon (2519)
Denmark Golden Day	do.	5440	29-7-35	5-1-44	240	22	5,190	4·67	242·76	Denmark Research Station	Denmark Damon (2519)
Wooroloo Empress	A.I.S.	23241	1-11-35	6-3-44	150	30	5,400	4·24	229·32	Wooroloo Sanatorium Farm	Parkview Guardian (2557)
Grantham Starbright's Queen 4th	Jersey	66778	3-5-38	31-8-44	240	8	4,755	4·70	223·77	J. A. Sears	Clarendon Eyre Oxford Pioneer (11484)
Mereworth Starbright's Princess 2nd	do.	63051	24-9-34	26-9-44	210	10	5,400	4·05	219·06	B. Langridge ..	Grantham Merry Starbright (9547)
Grantham Dreaming Fairy 2nd	do.	76596	20-4-39	18-8-44	210	6	4,005	5·37	215·16	J. A. Sears	Clarendon Eyre Oxford Pioneer (11484)
Grantham Easter's Jewel	do.	76598	9-7-38	9-7-44	210	4	4,290	4·66	200·25	J. A. Sears	Clarendon Eyre Oxford Pioneer (11484)
Glanavon Goldilocks	A.I.S.	36556	7-6-39	1-7-44	240	7	5,160	3·84	198·15	D. Bevan & Sons	Glanavon Franklyn (4827)
Narrogin Mabel	do.	26810	25 11-37	21-5-44	150	28·5	4,950	3·97	196·80	Narrogin School of Agriculture	Wooroloo Sterling 3rd (3626)
Glanavon Aster	do.	30575	18-1-38	20-2-44	180	14	3,410	5·54	188·94	D. H. Bell	Glanavon Nimrod (437)
Glanavon Thelma 3rd	do.	30605	25 1-39	7-3 44	210	10	4,770	3·90	186·33	D. Bevan & Sons	Parkview Commodore (306)
Kapara Sparkle 2nd	Jersey	77063	12-9-38	18 8-44	180	8·5	3,795	4·20	159·66	D. Bradford	Congelin Mandarin (14542)
Glanavon Sylvia 2nd ...	A.I.S.	30604	23-4 38	31-3-44	120	26	3,600	4·01	144·63	D. Bevan & Sons	Parkview Commodore (306)
Chittering Diana	do.	19575	7-7-35	15-1-45	90	25·5	2,655	4·36	115·95	Narrogin School of Agriculture	Range Sultan (1535)
Grantham Easter Rye 8th	Jersey	76597	18 9-38	1-9-44	90	23·5	2,595	4·42	114·42	J. A. Sears	Clarendon Eyre Oxford Pioneer (11484)
Narrogin Pinna	A.I.S.	38673	29-9-39	14-2-45	60	22·5	1,425	3·77	53·73	Narrogin School of Agriculture	Wooroloo Sterling 3rd (3626)
Crantock Golden Juliet	Jersey	85797	30-4-39	19-5-44	60	15	990	4·12	40·80	Mrs. G. H. Burnside	Congelin Eminent's Golden (13623)
Muresk Treasure	Guernsey	9118	12-7-39	26-7-44	60	8	480	4·30	20·64	Muresk Agricultural College	Muresk Homestead (2075)

Milking Machines.

M. Cullity, Superintendent of Dairying.

Reference was made to the rapid increase in the number of milking machines in operation in Western Australia in this journal, December, 1944. It was pointed out that machines had assisted very largely in overcoming labour shortages.

The further collection of data during the past year has shown that there has been a further substantial increase in the number operating and in the proportion of all cows which are milked by machine.

In 1943 the data collected referred to the number of stands or units, but did not include the number of complete machines, nor the number of cows milked by them. In the two following years more detailed information was available, allowing an accurate assessment of the increase in this form of milking.

The following table shows the increase in the number of complete plants and the total number of units: —

Year.	Machines.	Units.	Units per Machine.
1943	1,724*	5,006	2·90
1944	1,987	5,796	2·91
1945	2,237	6,655	2·97

* Estimated making an assumption that the average number of units per machine was 2·90.

The increase in the number of machines in two years was 513, or 29.75 per cent. of those installed in 1943. The number of units, however, was 1,649 or 32.9 per cent. greater. Apparently the machines newly installed during the year on an average were larger than those already installed, as while the average number of units per machine in 1944 was 2.9, those installed during the year contained 3.4 units each.

The most important feature of the available statistics is that showing that there has been an appreciable increase in the number of cows milked by machines. The following table has been prepared, not only to show the comparative number milked in the respective years, but also to indicate the distribution of machines in the Statistical Divisions. It will be noted as expected that the great preponderance of machines are in the South-Western No. 1 Division, which includes the major part of the heavy rainfall areas.

Cows Milked by Machine.

	COWS MILKED BY MACHINE.		
District.	1945.	1944.	1943.
Metropolitan	2,441	2,360	...
Northern Agricultural ...	537	686	...
South-Western No. 1 ...	76,891	70,935	...
South-Western No. 2 ...	1,702	1,521	...
Eastern Goldfields ...	547	490	...
Northern	53	27	...
	82,179	76,019	65,578*

* Estimated from the number of units, 5,006, and the assumed figure of 13·1 cows per unit, being that for 1944.

It will be noted that the increase in the number of cows machine milked in 1945, above those in 1944, was 6,160, while the margin in 1945, compared to 1943 was 16,601.

The extent to which the dairying industry has adopted mechanical milking is indicated in the following table:—

Division.	Dairy Cows Total.	Number Milked by Machine.	Percentage Milked by Machine. %
Metropolitan	4,028	2,441	60·1
South-Western No. 1 ...	103,941	76,891	74·0
Other Divisions	29,035	2,847	9·8
Total for W.A. ...	137,004	82,179	60·0

It will be realised that a large proportion of the cows listed under other districts exist in small herds in the agricultural areas, which are used largely for domestic supplies.

Another interesting feature of the present figures is that the average number of cows milked per machine has declined from 38.2 in 1944 to 36.7 for the latest period. If it is assumed that the same number of cows were milked in those sheds where machines were already installed in 1944, it is calculated that only 24.6 cows were milked per machine installed in the past year. It is possible this is a reflection of farmers' desire to overcome labour difficulties and it may be an indication of further considerable expansion of the cows milked by machine in future years.

Questions and Answers relating to Pig Management II.*

R. R. RUTHERFORD, Farm Manager and Demonstrator, Muresk Agricultural College.

Question.—Where pigs are predominantly fed grain, can oats with its high fibre content satisfactorily replace wheat, wholly or in part?

Answer.—Experiments overseas and in Australia show that at least 50 per cent. of the wheat in a ration may be substituted with crushed oats without loss of growth or carcase quality.

Question.—In summer, when green grazing is not available, what substitutes may be used?

Answer.—A small garden plot of lucerne, maize, spinach or silver beet, should provide ½ lb. of green feed per pig per day and this amount should meet Vitamin A requirements. Failing this, fish oil e.g., cod liver oil at the rate of one dessertspoonful per pig per day will supply nutrients normally found in green grazing. A further substitute for green feed may be found in well chaffed silage.

Question.—At what stage of growth should maize be cut for feeding to pigs?

Answer.—Maize to be utilised as green feed for pigs should be cut up to the time the plant flowers; after this stage it tends to become fibrous and indigestible. Therefore, cut maize so that the plot is finished at flowering time.

Question.—What is the best way to feed green maize to pigs?

Answer.—This is a matter of economics and providing the maize is young there should be no need to chaff it when feeding: on the other hand conditions may make it more profitable to utilise the maize as a grazing crop and eliminate cutting.

*For Series I. see this Journal, Vol. 22, No. 1, March, 1945, page 29.

Question.—Approximately how much wheat, with 10 per cent. meatmeal is required to produce: (i) a baconer, allowing for the feed of the service boar and the sow whilst pregnant; (ii) birth to a baconer 135 lb. dead weight; (iii) weaner 36-40 lb. (live weight) to 180 lb. baconer (light weight) or 130 lb. baconer (dead weight).

Answer.—(i) 10-11 bushels; (ii) 7-8 bushels; (iii) 6½ bushels.

Question.—Should a mineral supplement be fed?

Answer.—Yes—an adequate supply of mineral matter in the rations of all animals plays an important part in the maintenance of general constitution, resistance to disease, and in overcoming certain difficulties in breeding. The foregoing applies particularly to sows when it is realised that:

(a) Young pigs produced by the sow contain about 4 per cent. of inorganic or mineral matter;

(b) in addition to the producing of (a), the sow has to provide for her own mineral requirements, for digestive purposes, for replacement of mineral wastage from her own body, and during lactation for the secretion of milk containing 1 per cent. of inorganic or mineral matter.

Question.—How should the mineral supplement be fed?

Answer.—It should be mixed evenly throughout the feed.

Question.—How should water be provided for pigs? Are soaks suitable?

Answer.—Often pigs are allowed to drink from a muddy soak which is also being used by them as a wallow; the practice cannot be recommended as it encourages disease and general unthriftiness. Clean water is an essential at all times and should be provided in troughs which can be cleaned frequently and kept sweet by sprinkling with a little lime before refilling.

Question.—Is it advisable to run pigs of varying ages together on self feeders?

Answer.—No. Pigs of dissimilar ages require different rations and the feeding of such is not possible if pigs of all ages are run together. Pigs should therefore be divided into at least the following groups:—

(a) A group for "in pig" and empty sows which should have ample green grazing and be prevented from becoming over-fat. A boar could run with this group although it would be preferable to run him in a separate paddock;

(b) a group comprising a sow and her litter. This group should be alone until weaning at 8-10 weeks. Creep feeders are necessary for the piglets and the sow requires a ration, sufficient to enable her to maintain her condition and provide for her offspring;

(c) a group comprising pigs from weaners to porkers, i.e., 90-100 lb. live weight. This group is the rapidly growing group requiring a "forcing ration" relatively high in protein (at least one part meal to nine parts of grain). This will allow a proper skeletal and muscular system to be developed.

Question.—Is there a guide to the amount of food required by group (a) or pregnant sows?

Answer.—The condition of the sow is the best guide; she should be in forward to strong condition but not fat as in the latter case she may produce small litters, have insufficient milk when she farrows or become clumsy and kill some of her litter by lying or treading on them.

Question.—When and how should the sow that is freshening up to farrow be isolated from the other sows?

Answer.—About 10 days prior to farrowing she should be placed in a separate pen in which to farrow. The pen should have been disinfected after accommodating the previous sow, and be dry, clean, fresh, airy but not draughty, and should be provided with a farrowing rail 9 inches from the floor and the same distance from the wall. It is an advantage if the sun can shine into the pen for portion of the day.

Question.—Should the pen be floored and should the sow have plenty of straw?

Answer.—The pen should have a dry wooden floor, preferably movable, and standing on an underlying floor of concrete. Straw should be used sparingly for where large amounts of straw are provided, there is a risk that the piglets may burrow underneath and be crushed by the sow. Short straw such as pea straw, or equivalent, is better than long straw.

Question.—Should the sow due to farrow receive any special treatment?

Answer.—As sows confined to farrowing pens get less exercise than normally, the food should be made more laxative by (a) the use of bran; (b) increasing green feed; (c) 3-4 ozs. of Epsom salts in slop feed if and when considered necessary. Sows coming in from paddocks subject to round worm infestation may carry eggs on their udder and teats. In such cases, the sow, before confinement in her pen should have her udder and teats washed with warm soap and water to remove any eggs which may otherwise be passed to the young piglets.

Question.—Is it advisable to provide plenty of feed for the sow as soon as she has farrowed?

Answer.—No feed should be available for 24 hours after farrowing and that given for the next week should be light, laxative, and sloppy, so that it is easily digested. Plenty of clean fresh water should always be provided accessible to the sow. After the first 24 hours the sow may require 3-4 lb. of feed per day for the first seven days and up to 5-8 lb.per day by the end of the month. The amount will vary according to the sow and the size of the litter being maintained.

Question.—What is the duration of pregnancy in a sow?

Answer.—The time is usually taken as 16 weeks, but may vary from 109 to 125 days.

Question.—When should a sow that has farrowed be served again?

Answer.—Although oestrus or heat sometimes occurs a few days after farrowing, the majority of sows suckling young will rarely come on heat until 5-6 days (the time depending on the state of nutrition) after the young are weaned, that is at 8-10 weeks. Providing that the sow is in fair condition and not poor she should then be mated.

Question.—What is the cause of a sow eating her young and should one persevere with such a sow?

Answer.—The primary cause of this irregularity is dietary deficiency. If sows are receiving adequate protein and minerals in their ration it is very rarely that they will eat their young. If, however, the diet is deficient, a craving may develop and it is a wise plan for an attendant to be present at farrowing to prevent the sow eating the afterbirth. The consuming of afterbirth by the sow under conditions of dietary deficiency may prove a predisposing factor to the eating of the piglets; should the habit develop, the sow should be sold for slaughter.

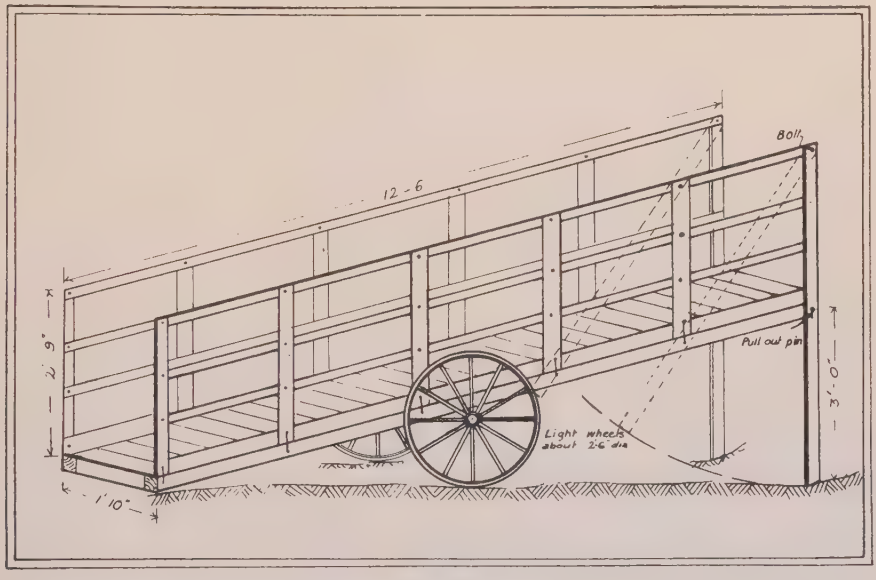
Question.—How many sows should a boar have in (a) his first season; (b) subsequent season?

Answer.—(a) 8-10 sows; (b) 30-40 sows, providing that the boar is used judiciously and is subject to reasonable conditions, i.e., he should be penned by himself and provided with shelter, shade, ample clean water, and have plenty of

room for exercise and, if possible, green grazing. While in service, he should be fed with nitrogenous foods. Green feed or substitutes should at all times be available. When out of service, his feed should be reduced to a level which will maintain good strong, forward, but not fat condition. Demands on the boar's service should be spaced out as evenly as possible. The most common mistake in the management of boars is to overfeed, and many good boars have been condemned for their failure to breed when the cause has been one of faulty feeding and management.

Question.—What is a good type of loading ramp which may be made on the farm?

Answer.—A suitable loading ramp can be made from a pair of old wheels and an axle (such as those from an old mower)—see Diagram. The axle is secured to the bottom of the race at a point which will give approximately 3 ft. height at the loading end of the race when it is in position. The loading end is provided with prop legs which are bolted at the top and pinned at floor level. When the pins are withdrawn, the legs can be swung out of the way to permit the moving of the race from place to place. The floor of the race is slatted to prevent the pigs from slipping. The lower portion of the race sides may be close boarded or as per diagram.



Question.—Could an approximate guide be given to the feed required for various aged pigs up to baconers?

Answer.—

(a) *GRAIN PLUS MEATMEAL (with green feed and mineral supplement):*

Pigs from 2-3 *weeks to* 8-10 *weeks old*—at 2-3 weeks creep feed ¼-½ lb. per pig per day and increase to 1-1½ lb. at 8-10 weeks on weaning (feed—crushed wheat 9 parts, meatmeal 1 part).

Pigs from 8-10 *weeks to* 32 *weeks old*—Average during this period approximately 2.5 lb. of feed for each lb. of live weight increase, that is ¼ lb. of feed increase in the ration weekly or ½ lb. fortnightly from the 8-10th week. This will make the ration per pig per day at 32 weeks or baconer stage approximately 6½ lb.

(b) *GRAIN PLUS SKIM MILK (with green feed and mineral supplement)*:

Pigs from 2-3 weeks to 8-10 weeks old—Creep feed as for (a) but substitute skim milk for the meat meal.

Pigs from 8-10 weeks to 32 weeks old—(1) Commence with 1 gallon of skim milk plus 1 lb. of crushed wheat. Throughout the period under discussion the amount of milk can remain constant and the crushed wheat increased by slightly less than ¼ lb. per week till approximately 5½ lb. is being fed at 32 weeks. Expressed in other forms, use in addition to 1 gallon of skim milk 1 lb. of grain for each month of age over 2 months. (2) Where ample skim milk is available, it may be found more economical to increase the quantity of skim milk and reduce the amount of grain fed per day. When such a policy is adopted, each additional gallon of skim milk may be taken as roughly equivalent to 1 lb. of grain and substituted in the preceding ration.

N.B.—All references to meat meal refer to the Midland Abbatoirs product.

Question.—As a guide, what are the approximate relative values of various feed materials?

Answer.—

10 lb. of skim milk=1 lb. of grain in feed value. N.B.—Neither should be fed alone.

Skim milk, dried butter milk and meat meal are practically equal as supplements to a grain ration.

1½ gallons or 15 lb. of skim milk=1 lb. dried butter milk or 1 lb. meat meal.

(Whey may be regarded as ½ the value of skim milk.)

As supplements to skim milk, crushed wheat and pollard are approximately of equal value.

1 lb. of grain=8-12 lb. of cabbage, cauliflower or melon.
=15 lb. pumpkin, kale, khol rabi, mangels, carrots or swedes.
=7-8 lb. turnips or apples.
=4-6 lb. potatoes, sweet potatoes or artichokes.

N.B.—The pig has a small stomach and the amount of bulk it can handle efficiently is limited.

Question.—How can suckers be hand reared if the sow dies?

Answer.—If possible, get another sow with a small litter about the same age to adopt them. This may be accomplished by putting the orphans with the foster mother a few times while she is nursing her own piglets, usually it will be then found that she will adopt the orphans without further trouble.

If no sow is available, they may be fed from a bottle or a dish 4-6 times daily with either of the following which must be fed warm (98 degrees F.)—i.e., blood heat:—

1. If the piglets are very young, the following should prove suitable if made up daily:

   Fresh cow's milk—1½ imperial pints.
   White and yolk of a fresh hen egg—about 2 ozs. or 4 tablespoonsful.
   Cod liver oil—½ teaspoonful.
   Slaked lime or chalk—1 saltspoonful.

2. If pigs are not so young, success has been achieved with warm, fresh, whole cow's milk fed 4-6 times daily about a quart per day.

N.B.—Great care must be taken to keep utensils clean. Solid food should be made available for all orphans as soon they can be taught to eat (2-3 weeks old).

Subterranean Clover Seed Production.

G. R. W. Meadly, Assistant Government Botanist.

An account of the development of subterranean clover in Australia makes interesting reading. It is the history of a plant, which in its native habitat in Western and Southern Europe, is of minor importance agriculturally, in fact at times classed as a weed. Following accidental introduction into Australia over fifty years ago, this plant has thrived in its new surroundings and has now become the most important annual clover grown in Australia.

Farming practices in many parts have been revolutionised by the introduction of a plant which has converted thousands of acres of previously despised virgin land into highly productive pastures. The large increase in these pastures during recent years is closely linked with the vast improvements in seed gathering and cleaning technique resulting largely from the ingenuity of the seed producers themselves.

The methods adopted for harvesting other species of clover seed cannot be used in the case of subterranean clover for, as the name implies, a large proportion of the seed is produced in the soil in much the same way that peanuts develop. For those who are not fully acquainted with the habit of growth of this clover, I would explain that each seed head consists of usually three or four small single-seeded pods surrounded by numerous strong bristles. The flowers are produced in a normal manner but soon after flowering the heads turn downwards and many of them force their way into the soil, sometimes to a depth of two inches, but usually somewhat less. In the case of the early (Dwalganup) strain, practically all the burrs are buried but the midseason and late strains produce a proportion on the surface. Thus with subterranean clover we have two unusual features; the seeds enclosed in strong burrs and many of the burrs buried in the soil. Although representing an aid to natural re-establishment, both of these characteristics have provided problems for seed producers.

Seed is gathered extensively in South Australia and Western Australia and to a lesser degree in Victoria, New South Wales and Tasmania. Even during the war years this State produced several hundred tons of cleaned seed annually, much of which was exported to the Eastern States and New Zealand. Smaller quantities reached South Africa and America.

The large variations in climate and soil in the different States have given rise to a diversity of methods for harvesting and cleaning but I propose to limit my comments to the technique followed in Western Australia. Although some raking, including hand raking, is still practised in this State, most of the seed is gathered by an ingenious and more effective method. Firstly the dry clover and weed straw is removed by means of grazing, mowing or burning. In the case of the early (Dwalganup) strain most of the burrs are buried and the seed is seldom appreciably damaged by burning the paddocks. As mentioned previously, however, the mid-season (Mt. Barker) and later strains develop a large proportion of their burrs on or near the surface, especially when growing on the heavier soils and where an abundant top growth is allowed to develop. The risk of damage is therefore greatly accentuated, especially if rushes, manure, dry sticks, etc., occur freely as they ignite and destroy the viability of the seed in their vicinity. Burning, besides damaging the seed, also destroys much valuable feed.

SUBTERRANEAN CLOVER.

(*Trifolium subterraneum, L.*).

PLATE I.

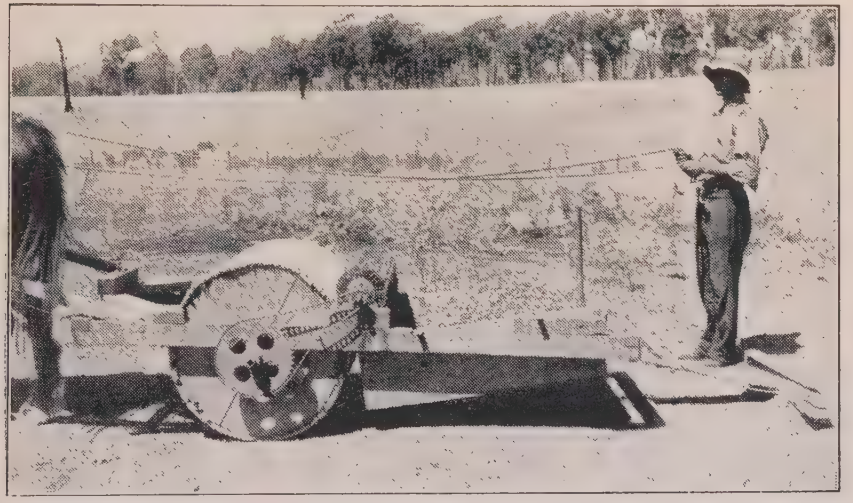
Explanation of Plate.

A. and B.—Portion of plant showing habit and development.
C.—Leaf showing whitish crescent-shaped markings.
D.—Leaflet with brown flecking (on veins near midrib).
E.—Flower.
F.—Maturing seed head.
G.—Ripe burr with three pods.
H.—Seed.

The alternatives for removing the roughage are mowing, raking or heavy grazing when dry. These methods have been employed with success but some producers claim they cannot adopt them, firstly because their paddocks are not sufficiently free of stumps to use a mower or rake; secondly, they are too large to ensure close grazing over the entire area, and thirdly, mowing is too costly. These are very debatable points and the farmer's outlook is often influenced by whether he regards seed production as a major undertaking or merely a sideline.

If the producer decides that burning cannot be avoided, every care should be taken to minimise the risk of damaging the seed. The area to be gathered should be grazed to reduce the amount of top growth and thus moderate the fire. Usually burning is carried out in the evening but some growers favour an early morning burn when the ground and roughage are cool and often moistened by dew. Following the reduction of the roughage by whichever method is adopted large sticks and stones should be removed as these damage the rollers and also decrease their efficiency by creating an uneven surface.

Normally the next operation is to loosen the surface soil and expose the burrs. It is impossible to generalise regarding the best type of implement to use. Sometimes no loosening is necessary, at others pasture harrows give satifactory results while often with the Dwalganup strain, especially under Great Southern conditions, a scarifier is used to advantage.



A SINGLE GATHERING UNIT.

The paddock is now ready for gathering and the gathering machine in general use consists essentially of a hollow wooden roller about 3 ft. long and 2ft. 6ins. in diameter, a brush 3 ft. long and 9 ins. in diameter, and a loose box, all fitted to a frame bearing shafts. The roller is covered with sheepskin showing 1-1½ in. staple and the brush is set to revolve in such a position that it brushes or flicks the burr from the wool and at the same time tends to tease the fleece. The brush is driven by a belt or chain from a pulley on the end of the roller at a speed of approximately four times that of the roller. Various modifications have been made to the brush and it is understood some are covered by patents. A somewhat more elaborate machine with the roller composed of independent segments is also being manufactured.

The box is so fitted to receive the burr when it is removed from the fleece by the revolving brush. The smallest unit is a single horse-drawn machine but the machines are used in various combinations with both horse and motor power. Where large flat areas are being harvested a number of rollers are often pulled behind a truck. Light harrows designed to scarify the surface are dragged behind each set of rollers in order to bring more burrs to the surface for subsequent rollings as the same area may be traversed several times, depending on the amount of burr present.

Depots or dumps are established in the paddocks where the burr is passed over large sieve tables or revolving cylindrical screens, the mesh used being selected to retain the burr and allow grit, sand, etc., to pass through. This process, although simple, is most important when dealing with gritty or gravelly soils as pebbles approximately the same size as the seed can be largely eliminated at this stage but present a problem after the seed has been extracted from the burr.

The burr is now ready to be treated by some form of dehulling machine. The type mainly in use relies on the principle of rollers with rough or banded surfaces revolving at a fast speed in concaves formed of strong woven wire. This operation disentegrates the burr, the seed along with the waste material falling through the mesh of the concave and being largely separated by means of a regulated current of air produced by a large bladed fan. A wheat header has been used for this purpose by modifying the thrashing drum and making other adjustments.

At this stage usually many of the seeds still remain in their pods or "coats." These are removed by a "decoater" which takes a number of forms, but in the main consists of a roller covered with woven wire gauze revolving in proximity to a concave surfaced with some brushing material such as a fibre door mat. Even in the absence of coaty seeds, it is often advisable to use this machine, as the abrasive action on the seed coat is sufficient to greatly reduce the hard seed content of lines containing a high proportion of hard seeds. By this means the immediate germinating capacity is increased. Various types of graders and polishers, incorporating sieves, air blast and centrifugal force are then utilised to produce the final graded sample. Very few lines of seed exported from this State have a pure seed content of less than 98 per cent. and many consignments exceed 99 per cent.

Experienced producers hold different views as to how pastures intended to be used for seed gathering should be managed. One school considers that the paddocks should have little or no grazing for the entire season. No experimental work has been conducted to test this assertion, but, although the seed may be somewhat larger, there is no conclusive evidence to show that the yield is higher than from an area grazed during the earlier part of the season but spelled after the commencement of flowering. Even if the contention is correct most producers are not in a position to forego grazing of appreciable areas for an entire season.

Mowing, especially if delayed long after flowering has commenced, will reduce the seed yield but good gathering has resulted from areas cut early and this is not an uncommon practice. Such a procedure also helps to overcome the fire hazards discussed previously although maximum results in this direction are obtained by cutting the herbage when it is dry. Although then beyond its most nutritive stage as hay it provides useful food and considerable quantities of dry hay of this nature have been baled and pressed.

With the exception of utilising the pasture for grazing there is nothing to be gained by delaying the commencement of gathering after the herbage is dry and the soil in a suitable condition for rolling. In fact, an early start is advantageous as unseasonal rains sufficient to prevent further rolling are always to be

considered, especially in the South-West. Gathering in the Great Southern and Midland districts is often commenced in November or early December but pastures in the higher rainfall areas are seldom in a suitable condition before January.

ROLLERS IN OPERATION ON THE PROPERTY OF MR. P. D. FORREST, BOYUP BROOK.

No hard and fast rule can be laid down as to the maximum number of times an area should be traversed by the rollers. This is governed by two considerations: firstly, whether the amount of burr obtained represents a profitable return for the effort expended, and secondly, the effect on the pasture in subsequent years. The first consideration is closely linked with the total area available for harvesting and the amount of seed required. The second is influenced by several factors including the strain, age of the pasture and the district in which it is growing. To consider these factors:—The Dwalganup strain seeds more heavily than the midseason strain and the higher yields allow more seed to be taken from the soil without affecting subsequent stands. The age of the pasture is important as normally maximum seed production is not reached until the pasture has been established for three or four years. Again, each year further hard seeds are produced which remain in the soil without germinating and after a period of a few years represent quite a proportion of the seed gathered. If a pasture is subjected to a number of rollings soon after it has been established and before the hard seed reserve has been built up, a depleted stand can be expected in the following year and even later, if associated with unfavourable seasons. This applies especially to the midseason strain but there have been experiences of a similar nature with the Dwalganup strain when located near the limit of its range in districts having a short growing season.

On the other hand, thoroughly established pastures are often rejuvenated after large quantities of seed have been gathered from them. Paddocks of the early strain have yielded ten hundredweights of cleaned seed per acre in one gathering operation and still provided excellent pastures the following year. Paddocks have also been gathered several years in succession without any serious affect on the pasture.

Greater Birdsfoot Trefoil.

(*Lotus uliginosus* Schkuhr.)

C. A. Gardner, Government Botanist, and H. G. Elliott, Agrostologist.

THIS perennial birdsfoot trefoil, commonly, but erroneously called "*Lotus major*" is generally regarded as one of the most nutritious, and is certainly the most valuable species of *Lotus* in cultivation in Australia. The genus *Lotus* is related to the true trefoils and the clovers, but can at once be distinguished from these by its leaves. The clovers and trefoils are trifoliate, i.e., they possess three leaflets on a common stalk, with a pair of small pointed organs (stipules) at the base which are quite unlike the leaflets in shape and texture. In *Lotus*, on the other hand, the stipules are leaf-like, and thus the leaf appears to consist of five leaflets, one pair being at the base of the leaf-stalk (the stipules), while the other three are arranged at the summit. This characteristic is one that can be readily observed in the field. The flowers are much larger than in either the trefoils or the clovers, and more distinctly stalked in a loose cluster or head.

Five species of *Lotus* are of local interest. The only native species, (*L. australis*) is widespread over the pastoral areas, and extends as far south as Northampton and Yalgoo, and almost to Kalgoorlie, thence to the De Grey district. It has pink or purple flowers. At one time regarded as a useful forage plant, it is now found to contain a cyanogenetic glucoside called *lotaustralin,* and thus, under certain conditions is toxic to stock. It is rarely found in the South-West, but has been introduced in a few localities, presumably by travelling stock.

The other four species are introduced; all of them have yellow flowers, and all are useful edible plants. The two annual species "Boyd's clover" (*L. hispidus*) and "Giblett's grass" (*L. angustissimus*) are fairly common in pastures, and were formerly grown from seed, but are of comparatively short duration. The remaining two are both perennial, are larger and more robust than the annual species. *Lotus corniculatus* is usually found in dry situations, while *L. uliginosus* is essentially a plant of pastures or waste places which remain moist in the summer.

The two perennial species may be distinguished by the following characteristics:—In *Lotus corniculatus* the stem is solid or almost so, and does not root from the joints; the stipules (lowest pair of apparent leaflets) are sharply pointed; the flower-clusters contain usually 3 to 8 flowers, and the teeth of the calyx (the cup-shaped organ subtending the yellow petals) have the points of the upper pair (i.e., behind the large petal, or "standard") converging. The leaflets are usually a bright green, and more or less pointed. In *L. uliginosus,* on the other hand, the stems are hollow and root freely from the joints; the lowest pair of leaflets (stipules) are broad and blunt; the flower-clusters consist of usually 8 to 12 flowers, the uppermost pair of calyx-teeth are divergent. The leaflets are broad, pale green, and blunt. Both species are indigenous to Southern Europe, Asia Minor and North Africa.

Greater birdsfoot trefoil is usually known commercially as *Lotus major,* a botanical synonym for *Lotus uliginosus.*

LOTUS MAJOR (*Lotus uliginosus*, Schk).

Legend:

A. Flowering stem. B. Leaf. C. Inflorescence. D. Flower. E. Pods. F. Seed.—F1. *Lotus corniculatus*, F2. *Lotus uliginosus*. G. Pod after dehiscing. H. Basal habit. A., E., and H. slightly reduced; B. and G. natural size; C., D., and F. variously enlarged.

Like strawberry-, drooping flowered- and white-seeded subterranean clovers, the greater birdsfoot trefoil will withstand considerable periods of inundation. Like white-clover, it emits roots from its stems where these come into close contact with the moist soil. In addition, greater birdsfoot trefoil emits root-like underground stems; these send up leafy shoots around the plant thus enabling it to spread when it is grazed so heavily that the shoots above the soil cannot develop. The most vigorous growth is made during the spring and early summer months, but under ideal conditions it will continue to grow until frosts occur in the early winter.

SOIL PREPARATION.

As a rule the most suitable conditions where this plant thrives preclude the usual soil preparation, although when and where possible, a fine, well prepared seed bed is advisable, since this will ultimately ensure a good stand. Frequently the plant is sown after a burn, or on the damp ground as the water is receding.

SEED.

The seeds of greater birdsfoot trefoil are small and about five hundred thousand constitute 1 lb. In colour they are an olivaceous green, greenish brown, or brown, somewhat heart-shaped or almost round, smooth, not speckled. Seed from New Zealand frequently contains seeds of *Lotus hispidus,* while European seed samples are almost pure.

SOWING.

Greater birdsfoot trefoil is best suited to the lower South-West, requiring a moist climate. It does best on peaty soils, but will grow well on soils which vary from clay to a sandy loam. The best time for sowing is early in the spring after frosts may be expected. In certain areas, however, early autumn sowing can be carried out with success. Where the soil is carrying a heavy cover of weeds or grass it is difficult to establish the plant from seeds, and under those circumstances the planting of rooted stems is more successful. Where land can be cultivated, or little competition by other species takes place, sowing seed at the rate of 4 lbs. per acre is recommended, since once the plants are established they will quickly spread and smother less vigorous pasture species.

INOCULATION AND FERTILISERS.

All leguminous plants in cultivation require intimate association with bacteria. With introduced pasture plants, it is the practice to inoculate the seed prior to sowing with a bacterial culture obtainable from the Department of Agriculture at a nominal cost, together with instructions regarding its use. Seed so treated should not be mixed with superphosphate before sowing, since the superphosphate destroys bacteria. The recommended method of sowing is that in which the inoculated seed is sown at the same time that the superphosphate is applied, but where no contact is made between the two. It is essential that the soil should be moist at the time of sowing. Superphosphate is essential to the success of greater birdsfoot trefoil, and should be applied both at the time of sowing, and thereafter in the autumn and spring. The usual rate recommended is 2 cwts. per acre per annum.

Lotus uliginosus can be regarded as a valuable plant for grazing or for hay.

For details of the plant see the accompanying illustration.

Dinoc—A Selective Weed-killer.

G. R. W. Meadly, Weeds Officer.

SUMMARY.

BROAD leaved annual weeds in onion crops can be controlled with dinoc. Spraying should be carried out when the weed seedlings are very small at which stage a 1 : 120 solution plus 2 lb. of sulphate of ammonia per 100 gallons at 100 gallons per acre is very effective and causes negligible damage to onions which have reached the two-leaf stage. Grasses have proved resistant to even stronger solutions.

There is only a small margin between the tolerance of flax and associated broad leaved weeds and even with weak solutions without an activator, appreciable damage to the crop has resulted. The extent of injury is not always similar with the same concentration and is influenced by such factors as temperature, humidity and soil moisture. Experiments indicate that the use of dinoc for killing weeds in flax in Western Australia is only advisable in the case of heavy infestations of broad leaved weeds which are likely to reduce very seriously the yield and quality of the flax.

Dinoc has proved an effective selective herbicide for treating lawns when it has also proved of fungicidal value. It has been used to advantage for controlling weeds in cereal test rows at the Agricultural Research Stations and also by commercial gladiolus growers.

As with all weed-killers, especially those used selectively, careful attention should be given to the concentration of the solution, the addition of the sulphate of ammonia when required and the rate of application.

INTRODUCTION.

During recent years much experimental work has been carried out with chemicals as weed killers, especially with those which have an appreciable degree of selectivity in their action, thus allowing weeds to be destroyed without harming the associated crop. Such substances as iron sulphate, sulphuric acid and arsenic pentoxide have been used for this purpose for some time, but the complex chemical compound sodium dinitro-orthocresylate was first developed as a herbicide in France in 1933. Some years elapsed before experimental work led to its recognition and commercial production in other countries but it is now marketed under a variety of trade names including dinoc in Australia and sinox in America.

Dinoc is an orange dye made from by-products of the distillation of coal. The commercial preparation is a dense suspension of fine crystals forming a paste consisting of 30 per cent. sodium dinitro-orthocresylate and 70 per cent. water. If allowed to stand, a watery layer forms above a firm mass of the chemical thus necessitating thorough mixing before use. It is readily soluble at the concentrations used for weed control.

The dry product is inflammable and is one of a number of compounds used as explosives. As the proprietary mixture contains water there is no necessity to handle dry material but it should not be allowed to dry out in open cans and should be washed from all equipment after use. It is toxic if taken internally in large doses and poisoning may also result from continued inhalation of spray particles, but it is relatively non-poisonous when compared with the arsenicals used for killing weeds.

Experimental work has shown that the addition of an acid salt such as sulphate of ammonia increases the effectiveness of the dinoc by raising the hydrogen-ion concentration of the solution. Such activated solutions are more toxic to all plants and in consequence are less selective in their action but have a decided advantage in securing comparable results with lower concentrations. They have their greatest value when there is a comparatively large difference in tolerance between the crop and the associated weed community.

It is quite apparent from the results of detailed experimental work in Australia and other countries that conditions, especially relative to temperatures and moisture, have a decided influence on the effect of dinoc on both weeds and crop. Trials have been carried out in this State on weeds in onions, flax, cereal crops and lawns and it is proposed to summarise the results with each.

EXPERIMENTS.

ONIONS.

Experiment 1.—On 8th September, 1944, at Mr. J. H. Arbuckle's property, Balcatta, a solution in the proportion of 1 gallon dinoc in 100 gallons of water plus 2 lb. of sulphate of ammonia was applied at the rate of 100 gallons per acre. The onions were of an average height of six inches with at least two true leaves and the weeds including summer grass (*Digitaria sanguinalis*) and barnyard millet (*Echinochloa Crus-galli*) were little beyond the cotyledon stage. The maximum temperature was 60° F. and 48 points of rain fell the second day after spraying.

When inspected on 5th October, the only weeds present were grasses, mainly summer grass, the spray having proved 100 per cent. effective against the broad leaved types including chickweed (*Stellaria media*) and sow thistle (*Sonchus oleracea*). The onions had not been affected. In an attempt to check the grasses the original plot was again sprayed at the same rate and concentration. An untreated section was also sprayed to ascertain the effect on the more mature weeds. The onions were now 9-12 inches high with 4-5 leaves and where not previously sprayed, the chickweed and thistle were six inches high and the summer grass and barnyard millet varied from seedlings to plants with a number of leaves and up to six inches across. The spraying was carried out when the temperature was 80° F. and the only rain during the following week was five points on the third day.

This further application caused virtually no reduction in the weed content of the first plot which, as mentioned before, at this stage consisted of grasses only and was equally innocuous against the grasses on the plot receiving its first treatment. Only partial control was secured with the chickweed and thistle, comparing unfavourably with the results of the initial spraying when the seedlings were small.

Experiment 2.—On 17th July, 1945, an experiment was commenced on Mr. W. Stephens' property, Balcatta to ascertain the effect of various concentrations of dinoc on both the onion crop and associated weeds. The five treatments were as follows:—

1. 1 : 120 dinoc solution plus 2 lb. sulphate of ammonia per 100 gallons.
2. 1 : 100 „ „ „ „ „ „ „ „
3. 1 : 80 „ „ „ „ „ „ „ „
4. 1 : 50 „ „ „ „ „ „ „ „
5. Control.

All treatments were applied at the rate of 100 gallons per acre the temperature being 64° F. and 74 points of rain falling four days after spraying. The onions were 4-6 inches high with 2-3 true leaves and the weeds, including some silver grass (*Vulpia sp.*), were very small being at the cotyledon and first leaf stage.

Observations made a week after spraying revealed that all concentrations had proved effective against the broad leaved weeds, but the silver grass, although burnt by the higher concentrations, was already recovering. The effect on the onions varied with the size of the plants and the concentration; the 1 : 50 solution causing appreciable browning. Later inspections confirmed that the range of concentrations was effective against all the seedling weeds except the grasses, although also reducing them to a certain extent. The difference of effect on the onions became less apparent although six weeks after spraying the "tipping" due to the 1 : 50 was still noticeable, less so with the 1 : 80, barely perceptible with the 1 : 100 and no apparent difference between the 1 : 120 and the control.

On 30th August previously untreated plots were sprayed with 1 : 80 and 1 : 100 solutions—each with sulphate of ammonia equivalent to 2 lb. per 100 gallons. In order to secure a complete cover of the comparatively large weeds the rate of application was slightly more than 100 gallons per acre. The maximum temperature was 65° F. and half an inch of rain fell the following day. The weeds which consisted mainly of nettle (*Urtica urens*), sow thistle, chickweed and capeweed (*Cryptostemma calendulaceum*) were 3-6 inches high and on sections formed a complete ground cover. Both treatments gave practically 100 per cent. kill against all weeds except some winter grass (*Poa annua*) of which only a few plants occurred. The apparent effect on the onions was not very severe and there was little evidence of injury three weeks after spraying.

The following yields of marketable onions were obtained on 28th November:—

Plot Number	1.	2.	3.	4.	5.	6.
Treatment	1 : 120	1 : 100	1 : 80	1 : 80	1 : 50	1 : 100
Date of application	17th July	17th July	30th Aug.	17th July	17th July	30th Aug.
Average yield per row	16 lb.	20 lb.	19 lb.	23 lb.	26 lb.	23 lb.
Equivalent yield per acre (tons)	7·1	8·9	8·5	10·3	11·6	10·3

The treatments in the field were in the same relative positions as in the table. Unfortunately the five rows in each treatment could not be randomised and consequently it is not possible to critically examine the figures or make comparisons with any degree of certainty but it is possible to record that an excellent yield of 11.6 tons per acre of marketable onions was secured following the application of the highest concentration used (1 : 50) when the plants were in the 2-3 leaf stage.

The crop generally, within and beyond the experimental section showed an improvement in vigour from left to right, i.e., from plot 1 to plot 6. With the exception of plots 4 and 6, this is reflected in the yield and it is probably not merely chance that these represent the plots sprayed in August after the weeds had been permitted to compete with the onions for some six weeks.

Experiment 3.—Mr. A. Upton of Harvey departs from the usual method of growing onions by not transplanting from a seed bed but making paddock sowings and using the "thinnings" for transplanting. The 1945 sowing, however, became heavily infested with wild radish (*Raphanus raphanistrum*) and, owing to the labour shortage, it was not possible to cope with the wild radish by inter-row cultivations and hand weeding.

When the Department was approached, the sown area was dominated by the weed growth, the wild radish leaves being up to one foot long and smothering the seedling onions which were mainly in the first leaf stage. It was realised that the onions were very vulnerable and the radish beyond the optimum stage for spraying. As the grower was resigned to the loss of the entire crop, however, sections were sprayed immediately with a 1 : 100 solution plus 2 lb. of sulphate of ammonia per 100 gallons at the rate of 100 gallons per acre. Although rain fell some few hours later a satisfactory degree of control was secured with the wild radish. Considerable damage was done to the onions, however, although a proportion of the larger ones survived.

The results of these three experiments may be summarised as follows:—

Effect on the Crop.—This varied considerably, depending largely on the size of the onion plants and the concentration of the solution. With seedlings in the cotyledon or first leaf stage severe damage is likely, even with comparatively weak solutions, e.g., 1 : 100, but the plants rapidly become more resistant. When at the 2-3 leaf stage and six inches high, although checked, plants are not killed by a 1 : 50 solution containing sulphate of ammonia. At this stage and later, only slight tipping is caused by 1 : 100 and 1 : 120 solutions.

Effect on Weeds.—The size and species of the weeds along with the concentration of the herbicide are the most significant factors. Cotyledon seedlings of plants such as chickweed, stinging nettle, sow thistle and annual clovers were killed by a solution as weak as 1 : 120, but grasses, even immediately after emergence of the first leaf, had a high degree of resistance. Silver grass did not succumb to a 1 : 50 solution and little reduction of summer grass and Japanese millet was secured with a 1 : 100 solution. A contrast to the resistance of the grasses was provided by wild radish, plants up to eight inches across being killed with a 1 : 100 solution.

Conclusions.

Dinoc can play an important part in the control of broad leaved weeds in onion crops. Spraying should be carried out when the weed seedlings are very small at which stage a 1 : 120 solution plus 2 lb. of sulphate of ammonia per gallon at 100 gallons per acre is very effective and causes negligible damage to transplanted onions. A further advantage associated with early sprayings is the short period for which the weeds act as competitors. Growers are unanimous that weeds allowed to grow in onion crops cause a drastic reduction in yield.

If for some reason, spraying is delayed until the weeds have reached a few inches in height, provided the onions are vigorous and have at least two strong leaves, somewhat more than 100 gallons per acre of a 1 : 100 or even a 1 : 80 solution can be used with safety.

The importance of attention to detail relative to concentration and rate of application cannot be overstressed. Somewhat disappointing results under field conditions were undoubtedly due to omitting the 2 lb. of sulphate of ammonia per 100 gallons of solution. This is only a small amount but plays an important part.

American experience indicates that it is inadvisable to spray when the temperature is above 90° F. or below 50° F. or following excessively cold or dry weather. Onions can well be sprayed soon after watering and no further watering is recommended within 24 hours. Although American reports refer to successful control of summer grass with dinoc, under local conditions this, and other grasses, have proved resistant.

FLAX.

During 1945 an experiment was conducted on the property of Mr. J. Mitchell, Donnybrook. The layout included five replications of 1/100 acre plots in randomised blocks and the four treatments were as follows:—

1. 1 gallon of dinoc in 120 gallons of water at 100 gallons per acre.
2. 1 gallon of dinoc in 100 gallons of water at 100 gallons per acre.
3. 1 gallon of dinoc in 80 gallons of water at 100 gallons per acre.
4. Control.

No sulphate of ammonia was included owing to the severe flax injury caused by activated solutions in 1944.

Spraying was carried out on 19th July, a clear day with a maximum temperature of 65° F. The flax was 2-3 inches high while the dominant weed, wild radish, was 4-6 inches across with 4-8 leaves. The ground was moist and 155 points of rain fell on the third day after spraying. Plant counts made on 23rd August gave the following figures. These represent the average of ten throws of a square link quadrat for each plot.

Treatment.

	1	2	3	4
Flax	25.4	25.4	22.3	43.3
Wild radish	0.42	0.40	0.24	1.46

A statistical analysis of the figures showed that there was an appreciable difference between the number of flax plants on the treated and untreated plots, but the differences between the effects of the three chemical treatments were scarcely significant.

Owing to the low weed content of blocks 3, 4, and 5, the analysis did not reveal any significant variation in the effects of the treatments on the wild radish although when the weedy blocks (1 and 2) were considered separately the disparity between treated and untreated plots exceeded the difference required for significance.

The reduced number of plants on the sprayed plots was associated with a thickening of the straw and a tendency for the plants to curve from the base rather than make erect growth. Another important aspect was the increased water erosion associated with the reduced vegetative cover on the sprayed plots. The experimental site was on a moderate slope but 1945 was a record wet winter.

Experimental evidence indicates that the use of dinoc for killing weeds in flax in this State is only likely to be practicable in the case of heavy infestations of broad leaved weeds, such as wild radish, which unless destroyed or checked will reduce seriously the quality and yield of the flax.

Experiments conducted by Mr. A. B. Cashmore, Senior Research Officer, Council for Scientific and Industrial Research, at Colac, Victoria, with comparable concentrations gave somewhat better weed control with less damage to the flax crop. The addition of 1 lb. of sulphate of ammonia per 100 gallons of a 1 : 100 solution caused severe injury to the flax when applied at the rate of 100 gallons per acre. A survey of literature available leads to the conclusion that results are influenced to an appreciable extent by such factors as temperature, humidity and soil moisture and there is always a danger of injury to crops such as flax which are little less resistant to the chemical than the weeds it is desired to kill. A wider margin of tolerance is certainly desirable when dealing with selective weed killers.

CEREALS.

Investigations carried out at the Avondale Research Station showed that capeweed growing in wheat could be readily controlled with a 1 : 100 solution without adversely affecting the wheat, apart from minor tipping.

Although the practicability of treating large areas of cereal crops in this State is very doubtful, dinoc is now being used successfully for controlling such flat leaved weeds as capeweed in the cereal test rows at the Research Stations, thus saving many hours of tedious hoeing.

LAWNS.

Trials with weeds growing on putting greens and other lawns have given very encouraging results and providing the sward is treated when the seedlings are small, a 1 : 100 solution plus 2 lb. of sulphate of ammonia per 100 gallons is a

satisfactory concentration. The chemical should be applied in the form of a fine spray at the rate of one gallon to 48 square yards, i.e., 100 gallons per acre. When treating bent grass lawns it is advisable to omit the sulphate of ammonia. Couch grass, however, is tolerant to higher concentrations, which can be used against the more resistant types of weeds. In America concentrations as high as 1 : 80 with 10 lb. of sulphate of ammonia per 100 gallons has been applied to the more persistent weeds at a rate of 1 gallon per 100 square feet but such treatments have not been tried locally. Lawn weeds that have been controlled by dinoc include flat weed (*Hypochoeris glabra*), chickweed (*Stellaria media*), Onehunga weed (*Soliva sessilis*), mustard weed (*Cotula australis*) and annual clovers (*Trifolium spp*).

A natural question to ask is—Does dinoc leave any toxic residue in the soil? It is an organic compound which is slowly decomposed by soil micro-organisms and tests indicate that the subsequent effect on plants is slightly beneficial due to small amounts of nitrogen becoming available. However, the increased vigour often noted probably results from a direct effect of the chemicals on the plants either by physiological stimulation or by control of pathogenic fungi. The sulphate of ammonia added as an activator also has a fertiliser effect.

Dinoc has been found very useful by commercial gladiolus growers for controlling broad leaved annual weeds and experience will add to the uses of this selective herbicide.

[*By courtesy of the Department of Agriculture, Tasmania.*]

A crop of barley showing the effect of treatment with Dinoc on a heavy infestation of Charlock.

ACKNOWLEDGMENTS.

Experiments were conducted on the properties of Messrs. J. H. Arbuckle, Balcatta, W. Stephens, Balcatta, J. Mitchell, Donnybrook and A. Upton, Harvey. Thanks are due to these gentlemen for their ready co-operation and practical suggestions. Also to George Wills and Co., Ltd., for making available the necessary chemical and Mr. R. D. Royce, Agricultural Adviser of this Department, for assistance with the experimental work.

Fertilisers.

The following Fertilisers have been Registered at the Department of Agriculture under the Fertilisers Act, 1928, for the year commencing 1st. Nov., 1945.

Name of Fertiliser.	Reg. No.	Brand.	By whom Registered.	Nitrogen (N) as				Phosphoric Acid (P_2O_5) as				Potash (K_2O) as		Cash Price per ton on rails at Works† or Perth.‡
				Nitrate.	Ammonia.	Blood and Bone	Bone-dust.	Water sol.	Citrate sol.	Acid sol.	Total.	Sulphate.	Muriate.	
A.—MINERAL.				%	%	%	%	%	%	%	%	%	%	£ s. d.
1.—NITROGENOUS.														
(*a*) *Nitrogen as Nitrate*—														
Nitrate of Soda	10	Cresco	Cresco Fertilisers (W.A.), Ltd.	15·50	....	....	....	....	....	....	....	....	....	18 10 0†
	19	Champion	R. Dundas Smith & Son	16·00	....	....	....	....	....	....	....	....	....	*
	28	Sickle	Cuming Smith & Mt. Lyell F.F., Ltd.	15·50	....	....	....	....	....	....	....	....	....	18 10 0†
	37	ML in diamond	do. do.	15·50	....	....	....	....	....	....	....	....	....	18 10 0†
	47	C.S.M.L.	do. do.	15·50	....	....	....	....	....	....	....	....	....	18 10 0†
(*b*) *Nitrogen as Ammonia*—														
Sulphate of Ammonia	11	Cresco	Cresco Fertilisers (W.A.), Ltd.	....	20·50	....	....	....	....	....	....	....	....	18 10 0†
	27	Sickle	Cuming Smith & Mt. Lyell F.F., Ltd.	....	20·50	....	....	....	....	....	....	....	....	18 10 0†
	36	ML in diamond	do. do.	....	20·50	....	....	....	....	....	....	....	....	18 10 0†
	46	C.S.M.L.	do. do.	....	20·50	....	....	....	....	....	....	....	....	18 10 0†
	53	Elephant	do. do.	....	20·50	....	....	....	....	....	....	....	....	18 10 0†
2.—PHOSPHATIC.														
(*a*) *Rock Phosphate*—														
Phosphate Powder	15	Cresco	Cresco Fertilisers (W.A.), Ltd.	....	....	....	....	....	....	....	27·50	....	....	7 8 6†
(*b*) *Superphosphate*	6	Cresco	Cresco Fertilisers (W.A.), Ltd.					13·00	2·50	1·50	17·00	....	....	4 17 3†
	7	do.	do. do.	....	....	....	....	14·00	2·50	1·50	18·00	....	....	5 3 6†
	20	Sickle	Cuming Smith & Mt. Lyell F.F., Ltd.	....	....	....	....	13·00	2·50	1·50	17·00	....	....	4 17 3†
	21	do.	do. do.	....	....	....	....	14·00	2·50	1·50	18·00	....	....	5 3 6†
	30	ML in diamond	do. do.	....	....	....	....	13·00	2·50	1·50	17·00	....	....	4 17 3†
	31	do.	do. do.	....	....	....	....	14·00	2·50	1·50	18·00	....	....	5 3 6†
	39	C.S.M.L.	do. do.	....	....	....	....	13·00	2·50	1·50	17·00	....	....	4 17 3†
	40	do.	do. do.	....	....	....	....	14·00	2·50	1·50	18·00	....	....	5 3 6†
(*c*) *Rock Phosphate and Superphosphate*—														
50/50 Phosphate	9	Cresco	Cresco Fertilisers (W.A.), Ltd.					7·00	1·50	13·50	22·00	....	....	6 16 0†
3.—POTASSIC.														
(*a*) Sulphate of Potash	17	Cresco	Cresco Fertilisers (W.A.), Ltd.	....	....	....	....	....	....	....	....	37·00	....	20 8 0†
	59	C.S.M.L.	Cuming Smith & Mt. Lyell F.F., Ltd.	....	....	....	....	....	....	....	....	25·00	....	13 18 0†

FERTILISERS—*continued.*

Name of Fertiliser.	Reg. No.	Brand.	By whom Registered.	Nitrogen (N) as				Phosphoric Acid (P_2O_5) as				Potash (K_2O) as		Cash Price per ton on rails at Works† or Perth.‡
				Nitrate.	Ammonia.	Blood and Bone	Bone-dust.	Water sol.	Citrate sol.	Acid sol.	Total.	Sulphate.	Muriate.	
3.—Potassic (continued).				%	%	%	%	%	%	%	%	%	%	£ s. d.
(*b*) *Muriate of Potash*	16	Cresco	Cresco Fertilisers (W.A.), Ltd.										60·00	29 17 5†
	29	Sickle	Cuming Smith & Mt. Lyell F.F., Ltd.										60·00	29 17 5†
	38	ML in diamond	do. do.										60·00	29 17 5†
	50	C.S.M.L.	do. do.										60·00	29 17 5†
4.—Nitrogen and Phosphoric Acid.														
Potato Manure, "C"	14	Cresco	Cresco Fertilisers (W.A.), Ltd.		3·50			11·00	2·00	1·50	14·50			8 4 8†
Do. "C"	22	Sickle	Cuming Smith & Mt. Lyell F.F., Ltd.		3·50			11·00	2·00	1·50	14·50			8 4 8†
Do. No. 2	32	ML in diamond	do. do.		3·50			11·00	2·00	1·50	14·50			8 4 8†
Do. "C"	41	C.S.M.L.	do. do.		3·50			11·00	2·00	1·50	14·50			8 4 8†
5.—Nitrogen Phosphoric Acid and Potash.														
Potato Manure, "A"	13	Cresco	Cresco Fertilisers (W.A.), Ltd.		2·50			10·00	2·00	1·00	13·00	5·00		9 15 7†
Do. "A2"	23	Sickle	Cuming Smith & Mt. Lyell F.F., Ltd.		2·23			8·89	1·56	1·11	11·56	4·45		9 0 1†
Do. "AM"	24	do.	do. do.		2·50			11·00	1·75	1·25	14·00		5·00	9 15 7†
Do. "A2"	33	ML in diamond ..	do. do.		2·23			8·89	1·56	1·11	11·56	4·45		9 0 1†
Do. "AM"	34	do. ..	do. do.		2·50			11·00	1·75	1·25	14·00		5·00	9 15 7†
Do. "A2"	42	C.S.M.L. ..	do. do.		2·23			8·89	1·56	1·11	11·56	4·45		9 0 1†
Do. "AM"	43	do. .. .	do. do.		2·50			11·00	1·75	1·25	14·00		5·00	9 15 7†
Tomato Manure	48	do.	do. do.		3·50			9·00	1·50	1·00	11·50		8·00	11 12 3†
Tobacco Fertiliser No. 5	49	do.	do. do.		2·80			10·87	1·88	1·25	14·00	2·50		8 19 4†
Liquid Manure	52	Faulding's	F. H. Faulding & Co., Ltd.	7·00				4·50			4·50	4·50		3s. per pint bottle.
6.—Superphosphate and Copper.														
	12	Cresco	Cresco Fertilisers (W.A.), Ltd.					13·00	2·50	1·50	17·00	Copper Oxide. 1·25		7 18 8†
Super. and Copper No. 1	25	Sickle	Cuming Smith & Mt. Lyell F.F., Ltd.					13·00	2·50	1·50	17·00	1·25		7 18 8†
Super. and Copper Ore	26	do.	do. do.					11·50	2·25	1·25	15·00	1·60		7 4 1†
Super. and Copper, No. 1	35	ML in diamond	do. do.					13·00	2·50	1·50	17·00	1·25		7 18 8†
Do. No. 1	44	C.S.M.L.	do. do.					13·00	2·50	1·50	17·00	1·25		7 18 8†
Super. and Copper Ore	45	do.	do. do.					11·50	2·25	1·25	15·00	1·60		7 4 1†

B.—ORGANIC.

(a) Blood and Bone—													
Animal Fertiliser	2	State Abattoirs, Midland Junct.	State Abattoirs, Midland Junction	8·00	....	..	.	5·00	5·00	....	....	9 5 0†
Blood and Bone	3	Apex	West Australian Meat Export Co.	5·00	....	..	..	....	13·00	...	....	*
Do. do.	4	Robb's	do. do.	5·25		.	..	14·00	14·00	..	....	10 4 3†
Do. do.	5	Eclipse	do. do.	6·00	.	..	.	12·00	12·00	..	..	10 9 3†
Do. do.	18	Albany Freezing Works	do. do.	6·00	..	.	..	....	12·00		..	10 0 0†
Do. do.	51	C.S.M.L.	Cuming Smith & Mt. Lyell F.F., Ltd.	5·00	..	..	....	15·00	15·00	.	..	10 10 0†
	54	A.N.A. Surprise	C. A. Kirkby & Sons	5·00	.	..	4·00	10·00	14·00	..	....	13 17 6‡
	55	Apollo	J. Kitchen & Sons Pty., Ltd.	7·00	.		4·00	10·00	14·00	..	.	
	56	Fitzroy	W. Angliss & Co. Pty., Ltd.	5·00	..	..	13·00	5·00	18·00	..	..	9 10 0§
	58	Riverstone	do. do.	5·50	...	....	9·25	5·00	14·25	.	.	7 15 0‖
(b) Dried Blood—												
Dried Blood	8	Cresco	Cresco Fertilisers (W.A.), Ltd.	10·50	.	.		....	1·50	.		13 0 0†
Do.	57	Riverstone	W. Angliss & Co. Pty., Ltd.	13·00	.	.	.	....	....		...	14 0 0‖
(c) Miscellaneous—												
Garden Manure	1	Sprout-Em	Kag Manufacturing Co.	....	5·00	....	5·00	4·00	9·00	.		* (sold in packets)

* On application.

§ Price at works, Victoria.

‖ Price at works, New South Wales.

Stock Foods.

The following Stock Foods have been registered at the Department of Agriculture under the Feeding Stuffs Act, 1928-1942, for the year commencing 1st July, 1945.

Stock Food.	Reg. No.	Brand.	By whom Registered.	Materials from which Made.	Registered Analysis.								Wholesale Price per ton at Works (W) or on rails, Perth (P).
					Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chloride.	Phos. Acid (P_2O_5).	Lime (CaO).	Other.		
					% (Min.)	% (Min.)	% (Max.)	%	%	%	%	%	£ s. d.
A.—Simple Foods.													
1.—*Meat Meals.*													
Meat Meal	2	ANCHO	Anchorage Butchers, Ltd.	Waste meat products	50·56	14·59	1·48	0·56	9·39	11·24	....	....	12 5 6 (P)
Do.	3	STATE ABATTOIRS, MIDLAND	State Abattoirs	do. do.	50·63	19·35	2·60	....	....	....	....	....	12 7 6 (W)
Do.	42	PANNIFEX	Burridge & Warren, Ltd.	do. do.	40·00	8·00	3·00	....	....	....	....	....	15 10 0 (P)
Do.	53	J.K.S. No. 1	J. Kitchen & Sons Pty., Ltd.	Animal fat and bone	44·00	5·00	1 00	....	14·00	....	....	....	13 10 0 (P)
Do.	61	PIONEER	Haynes & Clements, Ltd.	Meat and bone only	18·00	10·90	3·00	....	..	..	25·0% Mineral Matter, mainly Tri. calcic Phosphate		13 15 0 (P)
Do.	63	EXCELSIOR	Barrow Linton & Co.	Animal offal	45·00	10·00	1·50	....	....	....	....	....	12 8 4* (P)
Do.	70	IMPERIAL	W. Angliss & Co. (Aust.) Ltd.	Animal meal and bone	60·00	10·00	2·00	....	....	....	....	....	10 0 0 (W)
Bovina	69	do.	do. do. do.	Animal offals	47·00	8·00	1·00	....	....	..	....	....	9 0 0 (W)
Meat and Bone Meal	101	S.M.P.	W. R. & N. N. Clarke	Meat and bone meal	60·00	7·00					27% Minerals		9 5 0 (W)
2.—*Bone Meals.*													
Bone Meal	1	ANCHO	Anchorage Butchers, Ltd.	Waste meat products	23·63	2·44	Trace	Trace	26·76	26·95	....	....	13 5 6 (P)
Do.	40	WAME	West Australian Meat Exports	Bones solely	18·75	....	....	0·25	26·00	27·00	....	....	11 10 0 (W)
Bone Flour	43	TRI-CAL-OS	Davis Gelatine (Aust.) Pty., Ltd.	Sterilised bone flour	5·00	....	....		32·50	40·00	..		11 15 0 (W)
3.—*Other.*													
Linseed Sheep Nuts	59	M.L.M.	Elder, Smith & Co., Ltd.	Linseed	30·00	6·00	10·00	....	....	....	....	....	13 15 0 (P)
Linseed Meal	60	do.	do. do. do.	do.	30·00	6·00	10·00	....	....	....	....	....	13 15 0 (P)
Milk Sugar Food	37	KRAFCO	Kraft Walker Cheese Co., Pty.. Ltd.	Whey from cheese manufacture	10·00	0·50	....		1·00	0·70	Lactose 68·0	Riboflavin 25 u/gm.	25 10 0 (P)
Peanut Meal	4	ETA	Cruickshank Bros.	Peanut kernels	49·00	2·00	6·00		....	....	..	....	10 7 0‡
Wheat Meal	31	WESFARMERS	The Westralian Farmers, Ltd.	Wheat	10·00	2·00	2·00	....	....	....	....	....	7 0 0 (P)
Yellow Maize Meal	32	do.	do. do. do.	Maize	10·00	4·30	3·00	....	....	....	....	....	13 0 0 (P)

Wheaten Stockmeat	104	BRANATO	W. Thomas & Co., Ltd.	Wheat	8·00	...	5·00	....	....	....	....	....	7 5 0* (W)
Do. do.	105	POLLATO	do. do. do.	do.	8·00	....	5·00	....	....	....	....	....	7 5 0 (W)
Do. do. (Extra Coarse)	106	....	do. do. do.	do.	8·00	....	5·00	....	....	....	....	....	
Dried Buttermilk	107	SUNNY WEST	South-West Co-op. Dairy Farmers, Ltd.	Milk	36·20	6·40	....	Total Acid 8·4%			Milk Sugar 35·40	Lactic Acid 6·00	
B.—COMPOUND FOODS. (1.) *Cattle Foods.*													
Dairy Meal	27	WESFARMERS	The Westralian Farmers, Ltd.	Wheatmeal, bran, cocoanut meal, peanut meal, linseed meal, bonemeal, calcium carbonate, common salt, copper sulphate	18·00	4·00	8·00	Trace	....	Less than 5·00	Trace Minerals		11 12 6 (P)
Do.	45	VETAMAC	A. H. McDonald & Co.	Wholemeal, linseed meal, maize meal, bonemeal, molasses, salt, sulphate of iron, magnesium sulphate, sodium carbonate, potassium iodide	17·76	5·76	7·23	....	....	....	Minerals 8·15	....	26 15 0 (P)
Cattle Food	55	EVE-LYN	Tropical Traders, Ltd.	Linseed meal, linseed, pollard, salt, limestone chalk, animal charcoal, molasses, sulphur, sulphate of iron, copper sulphate, medicinal herbs	7·62	5·47	14·04	5·06	7·21	9·52	Minerals 6·46	..	21 5 0* (P)
More Milk	72	THOMAS	W. Thomas & Co. (W.A.), Ltd.	Peanut, linseed, cocoanut, wheat and bone meals, meatmeal†, dried yeast†, and minerals	19·00	4·50	6·50	..	....	.	.	....	14 10 0 (P)
Sweet Dairy Food	73	do.	do. do. do.	Wheatgerm, oat meal, bran, molasses, peanut, cocoanut, linseed, wheat and bone meals, meat meal†, dried yeast†, and minerals	15·00	3·00	7·00	..	..	.	.	..	9 15 0 (P)
More Cream	74	do.	do. do. do.	Peanut, cocoanut, linseed, and wheat meals, linseed†, meat meal†, dried yeast†, bone meal and minerals	13·00	7·00	6·50	..	..	..	.	..	14 10 0 (P)
Milk Food	97	WESTERN	David Gray & Co., Ltd.	Linseed, peanut and cocoanut meals, oat pollard, pollard, bone flour, salt, potassium iodide	30·00	3·00	10·00	....	2·0	2·5	..	....	13 0 0 (P)
Sweet Dairy Feed	98	do.	do. do. do.	Milk offal, wheat meal, oat meal, linseed meal, molasses, malt combings, cacos, salt, and other minerals	14·00	2·00	8·00	2·0	....	2·0	Trace Minerals		9 0 0 (P)

STOCK FOODS—*continued.*

Stock Food.	Reg. No.	Brand.	By whom Registered.	Materials from which Made.	Registered Analysis.							Wholesale Price per ton at Works (W) or on rails, Perth (P).
					Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chloride.	Phos. Acid (P_2O_5).	Lime (CaO).	Other.	
					%	%	%	%	%	%	%	£ s. d.
Lin-meal ..	99	WESTERN	David Gray & Co., Ltd	Linseed meal, yeast meal, malt, cacos, salt, copper sulphate, cobalt chloride, manganese sulphate	25·00	7·00	3·00	...	...	2·5	Trace Minerals.	13 0 0 (P)
Sweetened Dairy Meal	123	WESFARMERS	The Westralian Farmers, Ltd.	Oat meal, bran, molasses, linseed meal, peanut meal, clover, pollard, lime, sand, salt, blue stone, and bone meal	15·00	2·00	4·00	1·00		Less than 1·00	Trace Copper Sulphate .	10 4 0 (P)
(2.) *Calf Foods.*												
Calf Meal	28	WESFARMERS	The Westralian Farmers, Ltd.	Linseed meal, oat meal, wheat meal, maize meal, butter milk, meat meal, bone meal, liver meal, and minerals	18·00	5·00	8·00	Trace	.	Less than 2·00	Trace Minerals.	13 0 0 (P)
					(Min.)	(Min.)	(Max.)					
Calf Food ..	41	STAR	Robt. Harper & Co., Ltd.	Oats, linseed, maize, barley and rice meals, and condiments	12·50	12·50	6·00		.	..	... ...	18 0 0‡
Do. ..	44	VETAMAC	A. H. McDonald & Co., Ltd.	Maize meal, linseed meal, whole meal, mutton bird oil	20·23	13·13	5·75	.	..	.	Mutton Bird Oil. 10·00	37 10 0 (P)
Do. ...	58	EVE-LYN	Tropical Traders, Ltd.	Wheat, pollard, linseed, salt, sugar, minerals, and medicinal herbs	10·75	4·77	3·86	.	.		Total Ash. 5·98 Other Salts and Medicinal Herbs. 3·38	22 0 0* (P)
Do.	71	PARSONS	Parsons Bros. & Co., Pty., Ltd.	Rice, barley, oats, wheat, maize, linseed	11·50	14·00	6·50	.		.	. .. ...	21 0 0 (P)
Do.	75	THOMAS	W. Thomas & Co. (W.A.), Ltd.	Milk powder, peanut, cocoanut, linseed, wheat and bone meals, whole linseed, meat meal, dried yeast, and minerals	15·50	9·00	7·00				... .	16 10 0 (P)
Do.	100	WESTERN	David Gray & Co., Ltd.	Linseed, oats, peanut and cocoanut meals, milk powder and minerals	20·00	4·00	9·00	.	2·00	2·00	Trace Mineral.	14 10 0 (P)

3. *Sheep Foods*													
Maintenance Sheep Cubes	29	WESFARMERS	The Westralian Farmers, Ltd.	Oats, wheat, cocoanut, linseed, peanut, and pea meals, salt, lime, and molasses	14·00	4·50	6·50	Less than 2·00	....	Less than 1·00	....	....	12 0 0* (P)
Sheep Breeder Cubes	30	do.	do. do. do.	do. do. do.	18·00	7·50	7·50	Less than 2·00	....	Less than 1·00	....	....	15 10 0* (P)
Sheep Food	56	EVE-LYN	Tropical Traders, Ltd.	Linseed meal, whole linseed, pollard, salt, lime, molasses, minerals, and medicinal herbs	9·81	5·95	14·79	5·82	4·34	10·15	Sulphur. 2·63	Other Salts and Medicinal Herbs 4·04	21 5 0* (P)
Maintenance Nuts	120	WESTERN	David Gray & Co., Ltd.	Linseed meal, yeast meal, limestone, salt, and minor elements	16·00	3·00	7·00	0·50	....	....	$CaCo_3$ 1·50	....	10 16 0 (P)
Ewe and Lamb Nuts	121	do.	do. do. do.	Linseed meal, yeast meal, limestone, salt, and minor elements	25·00	6·00	10·00	0·50	....	....	1·50	....	13 10 0 (P)
(4). *Poultry Foods*													
Poultry Mash	20	WESFARMERS	The Westralian Farmers, Ltd.	Wheat meal, rolled wheat, bran, pollard, butter milk, coconut meal, lime, sand	14·00	2·50	7·0 0	....	....	Less than 3·00	....	..	8 17 6 (P)
Laying Mash	24	do.	do do. do.	Wheat meal, oat meal, butter milk, meat meal, bone meal, liver mealt, oyster shell, salt, bran	17·50	4·00	7·00	Less than 1·00	....	Less than 2·00	....	....	8 17 6 (P)
Protein Meal "A"	26	do.	do. do. do.	Bone meal, meat meal, butter milk, liver mealt, maize meal, oyster shell, salt	42·00	9·00	2·00	Trace	...	Less than 8·00	....	....	17 2 6 (P)
Protein Meal "B"	25	do.	do. do. do.	Meat meal, liver mealt, oyster shell, salt, bone meal	45·00	9·00	3·00	Trace	....	..	....	..	15 5 0 (P)
Poultry Laying Pellets	33	RED COMB	do. do. do.	Wheat, oats, meat meal, butter milk, lime, salt, and bran	17·50	4·00	7·00	Less than 1·00	...	Less than 2·00	....	..	9 7 6* (P)
Laying Allmash	49	MORLAY	R. B. Young	Wheat meal, bran, pollard, meat meal, bone meal, oyster shell flour, salt, linseed or coconut meal	14·50	2·00	6·00	....	....	....	....	....	9 15 0 (P)
Laying Mash	50	do.	do.	do. do. do.	15·00	3·00	6·00	....	....	....	....	....	10 10 0 (P)
Poultry Food	62	EGGOLEEN	Barrow, Linton & Co. ...	Meat meal, liver meal, bone meal, butter milk powder, salt, and other minerals	40·00	9·00	1·50	....	....	....	....	...	16 0 0* (P)

STOCK FOODS—*continued.*

Stock Food.	Reg. No.	Brand.	By whom Registered.	Materials from which Made.	Registered Analysis.								Wholesale Price per ton at Works (W) or on rails, Perth (P).
					Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chloride.	Phos. Acid (P_2O_5).	Lime (CaO).	Other.		
					% (Min.)	% (Min.)	% (Max.)	%	%	%	%	%	£ s. d.
Laying Mash	65	EGGLAYER	Barrow, Linton & Co.....	Bran, pollard, wheat meal, oat-pollard meat meal, lime and salt	17·15	3·50	4·25	....	....	....	....	....	9 10 0* (P)
Quick Lay	76	THOMAS	W. Thomas & Co. (W.A.), Ltd.	Meat, blood and bone meals, liver meal†, milk powder, peanut, coconut, linseed, and wheat meals, dried yeast, salt, lime, and other minerals	35·00	7·00	4·00	....	....	....	....	....	16 15 0 (P)
Laying Mash No. 1	77	THOMAS	W. Thomas & Co. (W.A.), Ltd.	Pollard, bran, wheat, meat, coconut, linseed, peanut, oat, pea, maize, and bone meals, wheat germ, Thomas quick lay, milk powder, dried yeast†, lime, salt and other minerals	16·50	4·40	7·50	....	....	....	....	....	9 12 6 (P)
Laying Mash No. 2	81	do.	do. do. do.	do. do. do.	15·50	4·50	7·00	....	....	....	....	....	9 12 6 (P)
Laying Mash "A"	89	WESTERN	David Gray & Co., Ltd.	Pollard, bran, "Western" egg food, yeast	17·00	3·00	7·50	....	....	....	....	....	9 2 6 (P)
Laying Mash "B"	90	do.	do. do. do.	Pollard (wheat meal), bran, bone meal, linseed meal, yeast, lime	16·00	3·00	7·50	....	2·00	1·50	....	....	9 12 6 (P)
Egg Food	91	WESTERN	David Gray & Co. Ltd.	Meat, fish, blood, linseed, and peanut meals, cocoa, lime, sulphur, potassium iodide and yeast	44·00	6·00	4·00	....	....	5·00	Minerals. 2·00	....	15 15 0 (P)
Pullet Food "A"	92	do.	do. do. do.	Meat meal, butter milk powder, linseed, peanut and cocoanut meals, cod liver and fish oils and minerals	32·00	6·00	1·50	....	2·00	2·00	Trace	Minerals.	18 10 0 (P)
Pullet Food "B"	93	do.	do. do. do.	Butter milk powder, meat meal, linseed meal, peanut and cocoanut meals, pollard, cod liver and fish oils, tobacco dust and minerals	25·00	3·00	4·00	....	2·00	2·00	,,	,,	18 10 0 (P)
Fattening Mash	94	do.	do. do. do.	Pollard, bran, oat meal, seed meal, barley meal, meat meal and minerals	17·00	4·00	9·00	....	2·00	1·50	....	....	9 5 0 (P)

Do. do.	64	DUKKO	Barrow, Linton & Co.	Bran, pollard, wheat meal, oat pollard, cocoanut meal, bone meal, biscuit meal, salt, lime	15·00	4·20	2·00	....	....	....	....	....	10 15 0	(P)
Do. do.	82	THOMAS	W. Thomas & Co. (W.A.), Ltd.	Oat meal, wheat germ, pollard, bran, peanut, linseed, cocoanut, wheat, bone, pea, maize and meat meals†, dried yeast†, salt, lime and minerals	14·00	3·50	7·50	....	....	....	....	....	10 0 0	(P)
Grower's Mash	23	WESFARMERS	The Westralian Farmers, Ltd.	Bone meal, wheat meal, bran, oat meal, butter milk, meat meal, wheat germ, oyster shell, salt	14·00	4·00	5·00	trace	....	Less than 2%	....	...	10 7 6	(P)
Grower s Pellets	34	RED COMB	do. do. do.	Wheat meal, bran, oat meal, butter milk powder, bone meal, wheat germ, salt, lime, sand	14·00	4·00	7·00	trace	....	Less than 2%	....	....	10 17 6*	(P)
Growing All Mash	47	MORLAY	R. B. Young	Wheat meal, bran, pollard, meat meal, bone meal, linseed or cocoanut meal and salt	13·50	2·00	6·00	....	....	....	....	....	9 10 0	(P)
Growing Mash	48	do.	do.	Wheat meal, bran, pollard, meat meal, bone meal, linseed or cocoanut meal, oyster shell flour, and salt	14·00	2·00	6·00	....	....	....	....	....	10 2 6	(P)
Do.	66	GROWELL	Barrow, Linton & Co.	Bran, pollard, wheat meal, oat pollard, maize, wheat meal, wheat germ, dried blood, lime and salt	16·00	3·95	4·56	....	....	....	....	....	10 0 0*	(P)
Quick Grow	80	THOMAS	W. Thomas & Co. (W.A.), Ltd.	Meat meal, blood meal, wheat, linseed, peanut, cocoanut and bone meals, dried yeast†, salt, lime and other minerals	35·00	7·00	4·50	....	....	....	....	...	15 5 0	(P)
(5.) *Chick Foods.*														
Chick Mash "A"	22	WESFARMERS	The Westralian Farmers, Ltd.	Bone meal, wheat meal, bran, oat meal, maize meal, liver meal,† meat meal, wheat germ, oyster shell, salt, codliver oil	17·00	4·00	5·00	....	....	....	Trace Minerals.	Cod Liver Oil 2%	12 10 0	(P)
Chick Mash "B"	21	do.	do. do. do.	Wheat meal, bran, maize meal, wheat meal, bone meal, wheat germ, buttermilk, salt, oyster shell, codliver oil	15·00	4·00	5·00	Less than 1%	....	Less than 2%	....	Cod Liver Oil 1%	11 10 0	(P)
Chick Pellets "A"	36	RED COMB	do. do. do.	Meat meal, bone meal, liver meal†, maize meal, wheat meal, bran, pollard, wheat germ, buttermilk powder, lime, salt, other minerals and codliver oil	18·00	4·00	5·00	....	....	....	Trace Minerals.	Cod Liver Oil 2%	12 17 6*	(P)

STOCK FOODS—*continued.*

Stock Food.	Reg. No.	Brand.	By whom Registered.	Materials from which Made.	Registered Analysis.								Wholesale Price per ton at Works (W) or on rails, Perth (P).
					Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chloride.	Phos. Acid (P_2O_5).	Lime (CaO).	Other.		
					% (Min.)	% (Min.)	% (Max.)	%	%	%	%	%	£ s. d.
Chick Pellets "B"	35	do.	do. do. do.	Buttermilk, liver meal†, bone meal, meat meal, maize meal, wheat meal, bran, wheat germ, salt, limesand	16·00	4·00	5·00	....	....	Less than 2%	....	....	12 0 0* (P)
Chicken Meal	38	PATRIOT	J. & W. Bateman, Ltd.	Wheat, pannicum seed, peas, maize, shell grit	11·80	3·00	3·80	....	....	....	....	.	19 0 0§ (P)
Chicken Mash	39	do.	do. do. do.	Pollard, bran, maize meal, oat meal, powdered milk, bone meal, meat meal, chick feed	15·80	4·20	4·30	....	....	....	....	.	28 0 0§ (P)
Chick Starter	46	MORLAY	R. B. Young	Wheat meal, bran, bone meal, maize meal, buttermilk powder, salt, cod liver oil and shell grit	14·00	3·00	4·75	....	....	....	....	....	14 5 0 (P)
Chick All-Mash	51	do.	do.	Wheat meal, bran, meat meal, bone meal, maize meal, buttermilk powder, shell grit	13·00	1·00	6·00	....	....	....	....	....	12 0 0 (P)
Chick Mash	52	MORLAY	R. B. Young.	Wheat meal, bran, meat meal, bone meal, maize meal, buttermilk powder, shell grit, salt	13·75	1·50	6·00	....	....	....	....	....	13 5 0 (P)
Starter Mash	67	VITALISER	Barrow, Linton & Co.	Bran, pollard, wheat meal, oat pollard, meat meal, wheat germ, dried blood, milk powder, limestone salt, fish oil	16·95	4·00	4·50	....	....	....	....	....	13 15 0* (P)
Chick Grain	68	CHIC CHIC	do. do. do.	Wheat, oats, maize, blue peas	10·50	3·00	5·10	....	....	....	....	....	11 10 0* (P)
Chick Grower	78	THOMAS	W. Thomas & Co. (W.A.), Ltd.	Pollard, bran, wheat, meat, cocoanut, linseed, peanut, oat, bone, maize and pea meals, wheat germ, milk powder†, dried yeast†, lime, salt and other minerals	14·50	3·50	6·50	....	....	....	....	....	13 0 0 (P)

Chick Starter	79	do. ...	do.	do.	do.	Pollard, bran, wheat, meat, cocoanut, linseed, pea, peanut, oat, bone and maize meals, wheat germ, milk powder, dried yeast†, lime, salt and other minerals	16·50	4·00	6·00	....	....	....	....	....	14	15	0	(P)
Chicken Grain	83	do.	do.	do.	do.	Wheat, peas, maize†, oats†, shell grit	12·50	2·30	7·00	....	....	....	....	..	14	0	0	(P)
Chick Food	87	ANCHOR	G. Wood, Son & Co., Ltd.			Wheat, maize oat, barley, pea, linseed and flake meal, oyster grit	16·42	2·02	2·92	....	....	....	....	...	17	10	0	(W)
Chick Starter	95	WESTERN	David Gray & Co., Ltd.			Pollard, bran, maize meal, cocoanut meal, wheat meal, yeast, wheat germ, bone flour, buttermilk powder cod liver oil and minerals	17·00	3·00	4·50	....	2·00	1·50	Trace Minerals.		13	5	0	(P)
Chick Builder	96	do.	do.	do.	do.	Pollard, bran, maize meal, linseed, bone meal, yeast, cod liver oil and minerals	15·00	2·50	6·50	....	2·00	1·50	....	....	11	10	0	(P)
Chicken Milk No. 1	102	THOMAS	W. Thomas & Co. (W.A.), Ltd.			Milk powder, meat meal, peanut, linseed, cocoanut, wheat and bone meals, calcium, carbonate, salt, potassium iodide, iron oxide, sulphur, magnesium sulphate, sodium sulphate	20·50	3·50	6·00	....	....	....	....	....	19	0	0	(W)
Chicken Milk No. 2	103	do.	do.	do.	do.	Milk powder, peanut, linseed, cocoanut, wheat and bone meals, calcium carbonate, potassium iodide, iron oxide, sulphur, magnesium sulphate, sodium sulphate	18·00	3·00	7·00	....	....	....	....	....	19	0	0	(W)
6.—*Pig Foods.*																		
Pig Food	54	EVE-LYN	Tropical Traders, Ltd.			Pollard, linseed meal, whole linseed, salt, lime, other minerals and medicinal herbs	10·25	10·51	12·35	2·12	4·44	9·60	Sulphur 3·76	Other Salts and Medicinal Herbs 2·73	26	8	0*	(P)
7.—*Horse Foods.*																		
Horse Food	57	EVE-LYN	Tropical Traders, Ltd.			Pollard, linseed meal, linseed (whole), salt, lime, other minerals and medicinal herbs	12·87	5·64	7·14	5·09	1·01	1·54	Sulphur 1·84	Other Salts and Medicinal Herbs 5·33	46	8	0*	(P)

STOCK FOODS—*continued.*

Stock Food.	Reg. No.	Brand.	By whom Registered.	Materials from which Made.	Registered Analysis.								Wholesale Price per ton at Works (W) or on rails, Perth (P).
					Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chloride.	Phos. Acid (P_2O_5).	Lime (CaO).	Other.		
					% (Min.)	% (Min.)	% (Max.)	%	%	%	%	%	£ s. d.
Sweet Horse Meal	122	THOMAS	W. Thomas & Co. (W.A.), Ltd.	Bran, molasses, oat meal, wheat germ, peanut, cocoanut, linseed, wheat and bone meals, meat meal†, Dried yeast† ,calcium carbonate, potassium iodide, salt, sulphur, magnesium sulphate, sodium sulphate	15·00	3·00	7·00	....	....	..	..	...	9 15 0 (W)
8.—*Dog Foods.*													
Dog Food	10	SNAPETTES	A. E. Robinson	Wheat, bone, meat, vegetables	15·25	13·00	4·00	....	4·00	5·00	....	....	4d. per lb.
No. 1 Dog Biscuits	11	SNAPS	do.	do. do. do.	15·00	4·00	2·00	....	3·50	4·00	....	..	6d. per lb.
Puppy Biscuits	12	do.	do.	do. do. do.	15·00	4·00	2·00	....	3·50	4·00	....	....	6d. per lb.
Hound Meal ...	13	do.	do.	do. do. do.	15·00	4·00	3·00	..	2·50	2·50	..	....	6d. per lb.
Plain Shapes	14	do.	do.	do. do. do.	15·00	4·00	2·00	....	3·50	3·50	..	....	4d. per lb.
Puppy Meal	15	do.	do.	do. do. do.	15·00	4·00	2·00	..	3·50	4·00	..	.	6d. per lb.
Charcoal Shapes	16	do.	do.	do. do. do.	14·00	3·00	6·00	..	2·50	2·50			6d. per lb.
Bone Shapes	17	do.	do.	do. do. do.	15·00	4·00	2·00	...	3·50	4·00	...	.	6d. per lb.
Dog Biscuits	18	BOANS LOCAL	do.	do. do do.	15·00	4·00	3·00	....	2·50	2·50	..	..	32s. per 100 lb.
Bone Shapes	19	SYMONDS	do.	do. . do. do.	15·00	4·00	2·00	...	3·50	4·00	.	....	6d. per lb.
Dog Biscuits	88	DUX	Boans, Ltd.	Flour, wheat meal, milk powder, bran, pollard, salt, fat and meat substance	....	....	....	....	....	....	....	....	£2 14s. 8d. per gross pkts.
C.—Stock Licks.													
Dicalcic Phosphate	5	C.S.M.L.	Cuming, Smith & Mt. Lyell F.F., Ltd.	Calcium phosphate, at least 90% of the P_2O_5 being as dicalcic phosphate	....	....	....	....	37·00	28·00	....	....	20 18 3 B, F 21 18 3 Bu 22 18 3 Ge
Copper Lick	6	do.	do. do. do.	Dicalcic phosphate, copper sulphate, salt	....	....	....	66·00	12·50	....	....	Cu 0·10	11 13 10 B
Denmark Lick Substitute	7	do.	do. do. do.	Limonite, sulphate of copper and salt	....	....	....	38·00	....	....	Fe 20·00	Cu 0·14	8 11 3 B 9 12 11 Bu
Dicalcic Lick	8	do.	do. do. do.	Dicalcic phosphate lick, salt and molasses	....	....	....	38·00	18·00	13·00	Molasses 5%	....	14 16 6 B
Mineralised Poultry Tonic	9	WATKINS	The J. R. Watkins Co.	Bone charcoal, dicalcic phosphate, ground salt, limestone, limonite and other minerals	....	....	...	14·00	15·70	23·70	Approx 7·00	Minerals	33 0 0

Stock Lick	84	SYKO LICK	Sykes Australian Branch, Ltd.		Salt, bone flour, and mineral	....	....	....	70·00	5·6	4·4	11·05 Minerals		23 12 0	(P)
Medicated Lick	85	VETAMAC	A. H. McDonald & Co.		Salt, bone meal, whole meal, molasses, minerals	....	....	....	50·00	6·90	5·50	6·15 Minerals		27 14 0	(P)
Mineral Concentrate	86	VETSOLICK	do.	do.	Bone meal, whole meal, and minerals	....	....	....	....	19·00	13·00	21·41 Minerals		32 10 0	(P)
Cobaltised and Copperised Concentrated "D" for Sheep	108	VITA-LICK	Goldsbrough, Mort & Co., Ltd.		Bone flour (degelatinised), bone charcoal, sodium sulphate, sulphur, limonite, potassium iodide, copper sulphate, cobalt, chloride and meals	....	....	....	....	23·00	29·30	Meals 21·10	Minerals 5·10		
Cobaltised and Copperised Mixed "D" for Sheep	109	do.	do.	do.	Bone flour (degelatinised), bone charcoal, sodium sulphate, sulphur, limonite, potassium iodide, copper sulphate, cobalt, chloride, salt and meals	....	....	....	80·00	3·70	4·70	3·39	3·392	32 10 0	(P)
Cobaltised and Copperised Concentrated "G" for Sheep	110	do.	do.	do.	Bone flour (degelatinised), bone charcoal, limonite, sulphur, potassium iodide, copper sulphate, cobalt chloride and meals	....	....	....	....	24·50	31·00	12·70	7·52	32 10 0	(P)
Cobaltised and Copperised Mixed "G" for Sheep	111	do.	do.	do.	Bone flour (degelatinised), bone charcoal, limonite, sulphur, potassium iodide, copper sulphate, cobalt, chloride, salt and meals	....	....	....	80·00	3·80	4·90	2·20	3·412	32 10 0	(P)
Cobaltised and Copperised Cattle Lick Concentrated "D"	112	do.	do.	do.	Bone flour (degelatinised), bone charcoal, sodium sulphate, sulphur, potassium iodide, copper sulphate, cobalt, chloride and meals	....	....	....	....	22·70	29·10	16·40	8·671	32 10 0	(P)
Cobaltised and Copperised Cattle Lick Mixed "D"	113	do.	do.	do.	Bone flour (degelatinised), bone charcoal, sodium sulphate, sulphur, potassium iodide, copper sulphate, cobalt, chloride and meals, salt and molasses	....	....	....	75·00	4·20	5·40	3·10	1·624	32 10 0	(P)
Cobaltised and Copperised Cattle Lick Concentrated "G"	114	do.	do.	do.	Bone flour (degelatinised), bone charcoal, sodium sulphate, sulphur, potassium iodide, copper sulphate, cobalt, chloride and meals	....	....	....	....	24·70	31·50	10·30	7·907	32 10 0	(P)
Cobaltised and Copperised Cattle Lick Mixed "G"	115	do.	do.	do.	Bone flour (degelatinised), bone charcoal, sodium sulphate, sulphur, potassium iodide, copper sulphate, cobalt, chloride and meals, salt and molasses	....	....	....	75·00	4·50	5·80	1·93	1·404	32 10 0	(P)

STOCK FOODS—*continued.*

Stock Food.	Reg.	Brand.	By whom Registered.	Materials from which Made.	Registered Analysis.								Wholesale Price per ton at Works (W) or on rails, Perth (P.)
					Crude Protein.	Crude Fat.	Crude Fibre.	Sodium Chloride.	Phos. Acid (P_2O_5).	Lime (CaO).	Other.		
					%	%	%	%	%	%	%	%	£ s. d.
Vita-Lick Mineral Mixture	116	V.M.M.	Goldsbrough, Mort & Co. Ltd.	Bone flour (degelatinised), bone charcoal, Spanish iron oxide, ferrous sulphate, sulphur, sodium sulphate and meals	....	....	....	4·50	9·50	12·50	60·20	3·47	19 10 0 (P)
Mineralised Salt Blocks	117	Vita-Lick	do. do. do.	Bone flour (degelatinised), sodium sulphate, calcium hydrate, sulphur, ferric oxide, ferrous sulphate, salt and potassium iodide	....	....	....	84·00	2·65	5·75	...	4·01	16 10 0 (P)
Porcovite	118	PORCOVITE....	do. do. do.	Bone flour (degelatinised), bone charcoal, sodium sulphate, sulphur, salt, limonite, calcium carbonate, copper sulphate, cobalt, chloride, potassium iodide, and cod liver oil	....	....	....	13·00	19·10	30·00	....	3·90	35 0 0 (P)
Chic-a-vite	119	CHIC-A-VITE	do. do. do.	Bone flour (degelatinised), bone charcoal, ferrous sulphate, sulphur, sodium sulphate, gentian, cod liver oil, potassium iodide, and meals	....	....	....	....	20·70	27·60	16·50	10·30	36 0 0 (P)

* Short ton. † When available. ‡ *Ex* wharf Fremantle. § Sack lots. B, at Bassendean. F, at Fremantle. Bu, at Bunbury. Ge, at Geraldton.

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